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AN

HISTORICAL, GEOLOGICAL, AND DESCRIPTIVE

VIEW

OF

THE COAL TRADE

OF THE

NORTH OF ENGLAND;

COMPREHENDING ITS

RISE, PROGRESS, PRESENT STATE, AND FUTURE PROSPECTS.

TO WHICH ARE APPENDED

A CONCISE NOTICE OF THE

PECULIARITIES OF CERTAIN COAL FIELDS

IN

GREAT BRITAIN AND IRELAND;

AND ALSO A GENERAL

Description of the Coal Mines of Belgium,

DRAWN UP FROM ACTUAL INSPECTION.

BY MATTHIAS DUNN,

COLLIERY VIEWER AND MINING ENGINEER.

BIBLIOTHECA BODLEIANA

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PREFACE.

THE subject upon which I have undertaken to write, stands pre-eminent, in a commercial point of view, in respect to the national resources of Great Britain; and it is chiefly to the developement of this portion of those resources, that I have devoted the following pages. At the same time, it may not be irrelevant that I enter upon the important subjects of the nature of coal, its geological position, and its chemical composition.

According to Werner, one of the most celebrated of the continental geologists of the day, our globe consists of successive deposits amidst an ocean of water. We have, first, primitive rocks, in a state of crystallization, and as the basis in which silica predominates, (*i. e.* granite,) upon which all other formations rest. Next to granite we have gneiss, or slaty granite—then slates with a diminished proportion of crystalline. Serpentines, porphyries, and trap succeed, all of which are still less crystallized. In the course of the changes which have taken place, we find that primary deposits have been destroyed, and new rocks have been formed by the *debris* of the above-mentioned primary formations.

In these convulsions, and at this era, living nature took date; and also *Coal, a mineral formed from vegetables.* Lime, which had already been associated with primitive rocks, became more abundant; and to this era also belong salt rocks, and other coeval formations.

The Wernerian principle has been simplified by Messrs. Coneybeare and Philips, agreeable to the following tabular form :—

	Modern Names.	Wernerian Names.	Former Names.
1. Formations—Sand and Clay above the Chalk - -	Superior Order.	Newest Flœtz Class.	Tertiary.
2. Chalk—Sands and Clay beneath the Chalk; Calcareous Freestones (Oolites), and Argillaceous Beds, New Red Sandstone, Conglomorate, and Magnesian Limestone - - -	Supermedial Order.	Flœtz Class.	Secondary Class.
3. Carboniferous Rocks. Coal Measures. Carboniferous Limestone. Old Red Sandstone.	Medial Order.	Sometimes referred to the preceding, sometimes to the succeeding.	
4. Roofing Slates, &c., &c.	Sub-medial Order.	Transition Class.	Intermediate Class.
5. Mica Slate. Gneiss. Granite, &c.	Inferior Order.	Primitive Class.	Primitive Class.

The rents in the strata formed during these convulsions, became filled with rocks of various kinds, such as granite, trap, &c., forming veins or dykes.

The metals, too, have their ages and their epochs, of which tin is the eldest; and silver and copper, the latest of formation. Gold and iron have been formed in almost every gradation of this stupendous process, and the nature of each specimen identifies the period of its formation.

The whole of the rocks are composed of silicious, argillaceous, and calcareous substances, but of different proportions; the lowest in the formation being most compact and crystalline, and the highest more loose and earthy.

Coal belonging, then, to the third series above described, and now universally admitted to be of vegetable origin, may be comprised under the following distinctions:—

1.—Lignites, a species of mineral charcoal or intermediate gradation, from wood to coal.

2.—Ordinary bituminous coal, of numerous varieties.

3.—Anthracite, found generally in connection with the lowest portion of the third series, and sometimes in the primary rocks themselves.

Coal, then, appears to have been formed of large vegetable masses, of considerable extent, in strata varying from a few inches to many feet in depth; the said strata alternating with rocks wonderfully uniform, and which consist, in most cases, of the following:—Sandstone, slate clay or shale, fire clay, iron stone, limestone, &c.; but we find the rocks participating of both the clay and sandstone texture, greatly predominant.

The coal beds are indiscriminately accompanied by rocks either of sandstone or shale, which often rest upon fire clay. It is in the shale accompanying the coal, that the fossil impressions are so numerous, for they are seldom found in the sandstones, or in the shales considerably distant from the coal beds.

It is worthy of remark, that the carbonaceous snbstances near to the surface, are more rough and coarse in their composition, than those lower down in the series, and that there is so continual an interchange in the composition of the strata, that with the exception of some of the thick beds of sandstone, they do not correspond in shafts situated at short distances from each other.

It may be here mentioned, that the slate clay is known in different localities by the respective names of black or blue metal, slate, clunch, cleft, bind, &c.; and the sandstones, by the names of post, plate, penant, &c. They are usually gritty, micacious, and tender, affording freestones for building; whetstones, grindstones, and flagstones, for pavements, and even for the roofing of houses.

The organic remains of the coal formation consist of many shells of fresh water origin. The fossils, with land plants, occur in great abundance and variety, belonging to extinct species, but bearing considerable analogy to those now growing only in tropical climates. These plants are mostly succulent, and of enormous growth.

Reasoning from the general character of the coal formation, we may conceive the luxuriant vegetation of that remote period to have been swept away by successive torrents into lakes and estuaries, and buried in succession beneath deposits of mud and sand, now consolidated into shale and sandstone; whilst the vegetable matter has been converted, by pressure and other circumstances, into coal, which forms so important an ingredient in our national wealth.

Having, as above, shortly endeavoured to develope the theory of the carboniferous strata, in doing which, I beg to acknowledge my obligations to the Author of the interesting history of Fossil Fuel, I now proceed to the subject more immediately the object of the treatise.

The coal mines of Great Britain undoubtedly contribute more than any other description of property to the wealth and aggrandisement of the country—for whether we view them in regard to the employment of capital and labour—the advancement of general commerce—the improvement of land—the appropriation of the wonderful power of the steam engine—the support of our navy—or the development of the arts and sciences —they form the basis, and stand pre-eminent as the cause of our national wealth and superiority. It is becoming daily a matter of greater surprise, that whilst France, Belgium, and Prussia so wisely husband and foster this description of property and the lives of persons engaged therein, the British Government have scarcely, as yet, ever turned their attention towards it in a legislative capacity, otherwise than to burthen it with taxation.

The subject, therefore, to which I have presumed to devote the following pages, is, I am well assured, in itself of sufficient importance to enlist the pen of a more able advocate; and I must, therefore, earnestly entreat the indulgence of the reader, whilst I candidly acknowledge my inability to do sufficient justice to a subject of such vital importance.

My first duty is, to explain the object I have in view, and to guard against the expectancy of an elementary detail of all the processes required in the winning, and working of collieries. Indeed, such was my first intention; but I was deterred by the reflection, that, as the work mainly applied to this part of the country, in which so many persons are already well informed with respect to the practical department, and which has been so often detailed in the Transactions of the Natural History and other learned societies, to compile a book of this nature, would not be interesting to the general reader.

I have, therefore, determined that this treatise shall consist of statistics, not only of this, but also of other coal districts in the United Kingdom, which I have, from time to time, personally examined, and with which I have been more or less connected, during a professional practice of upwards of thirty years. I have also availed myself of the information elicited during the various parliamentary examinations into the state and bearing of the trade.

The cause and effect of explosions and other accidents, have likewise demanded considerable attention, with a view of enabling a judgment to be formed as to how far parliamentary legislation may be instrumental to the saving of life, whilst it may tend to the economizing of those invaluable mines which constitute the basis of our national commerce; and, lastly, I have ventured to review the present state of the trade, with the causes of its present depression, and its future prospects.

Having also visited the Belgian coal field during the course of last year, I am enabled to communicate some interesting facts relative to it.

In the execution of this arduous task, I must again solicit indulgence; and although I may fail to afford full satisfaction, yet I hope I may be enabled to lighten the labour and to facilitate the exertions of future writers, who may handle the subject with more success. It will, at any rate, afford to me one gratification, viz., that my observations, in the cause of humanity, may perhaps strengthen the hands of those philanthropic persons who are now exerting themselves to better the condition of the miner, whilst they economise the property upon which so much of the future well-being of society depends.

ERRATUM.

Page 54, line 12, for "*inventor of the present principle of locomotion*," read "*inventor of locomotion on the present principle*."

VIEW OF THE COAL TRADE.

A FEW months ago, I published a brief historical review of the colliery engineering of this district, in the Gateshead Observer and the Mining Journal of London, and which review embraced a series of many years, viz., from 1700 to the present time. In consequence of the solicitations of a great number of persons interested in the trade, I have been induced to enter upon this important subject in a more extended form, both as regards this and the practice of other districts, bringing into notice some of the proceedings of parliament, and other important matters inherently involved in the history of the trade.

SECTION I.

GEOLOGICAL DESCRIPTION AND EXTENT OF THE NORTHERN COAL FIELD, FOSSIL IMPRESSIONS, PROBABLE DURATION, ETC.

THE geological formation of our district has been so often the subject of description, and so ably treated, by the learned professors of the day, that I will very cursorily glance at it. Suffice it to observe, that its form, like that of almost every other coal field, is basonic; the centre being taken to be the deep colliery of Monkwearmouth, from which point the coal strata may be said to have in every direction a general rise.

To the eastward, its formation and extent are, of course, veiled in the obscurity of the ocean; but its landward outcrop may be described as follows, beginning at the river Coquet, and terminating in the neighbourhood of the following towns and villages in the county of Northumberland, viz., Acklington, Morpeth, Prestwick, Callerton, Heddon, Ovingham, Mickley, and Newlands; and in the county of Durham at Heleyfield, Broomshields, Wolsingham Common, Bedburn, Woodlands, and Barnard Castle.

The south-eastern part of this district is overlaid by the magnesian limestone, the western verge of which is visible at Whitley, South Shields, Boldon, Pensher, Newbottle, Pittington, Aycliffe, Summerhouse, and so across the Tees into Yorkshire; and it is now becoming matter of great speculation how far beyond the present collieries to the eastward, the said coal field remains good. Deep winnings have already been made through the body of the said limestone at Monkwearmouth, Dawdon, Castle Eden, South Wingate, Trimdon, Hartbushes, and Bishop Middleham, all of which collieries have considerable fields of good coal to the westward; but to the eastward, the tract of country may be pronounced doubtful and inauspicious. In short, the southern limit of the *workable coal field* may be defined according to the following undulating line, viz., a little to the south of Castle Eden colliery, South Wingate, between Trimdon and Fishburn, thence to Bishop Middleham, Chilton, between Leasingthorne and Windleston, Eldon, Shildon, Brusselton, Evenwood, Keverston, Langley Dale, and Woodland Common, beyond which the red sandstone appears. From Castle Eden the strata commence to rise south and east; and as the coal measures thin, and the limestone thickens, so will every seam in succession be terminated at proportional distances under the German Ocean, which is calculated to take place at from one to ten miles. The Five-quarter seam has already disappeared; and at South Wingate considerable mystery prevails as to the others.

During the investigation before parliament in 1830, Professors Sedgwick, Coneybeare, and Buckland expressed considerable doubt of the existence of any great body of good coal underneath the extensive district of magnesian limestone lying to the eastward of Hetton, &c.; but the recent explorations of South Hetton, Haswell, Dawdon, Castle Eden, and Trimdon, have since greatly defined the limits, and we are consequently assured that this district does contain large fields of prime coal.

A striking fact belonging to this, as well as to many other coal formations, is the innumerable fossil impressions that are found embedded in the shales and sandstones contiguous to the coal seams, and which are generally the impressions of plants now known to exist only in tropical climates. This circumstance has led to a great many curious theories amongst geologists, of which the most prominent is, that the polarity of the earth must have been changed. Another curious phenomenon consists of those huge erratic whinstones, found in such abundance along the flat country to the eastward of Houghton, Ferryhill, &c., and supposed to belong to mountains in Cumberland and Westmoreland. By what strange event they could have thus been removed so far from their original locality, does, indeed, involve a mysterious theory.

To the westward, the public railways have been pushed forwards towards Crook, Brancepeth, Medomsley, and other internal districts, formerly thought so remote as to preclude any chance of their produce being conveyed to the sea, but which are now laid open to their very extremities. In the extreme north, the establishment of the harbour of Amble and Warkworth is laying the foundation for exporting the produce of large coal fields, hitherto almost untouched; and the district between that part of the coast and the Wansbeck may be said to be the only division which has not an outlet to the sea, all the rest being in progress of exploration.

With respect to the vast number of collieries now in operation, it may be matter of surprise, that, notwithstanding the generally inadequate return for the large capitals therein invested, not only are there scarcely any collieries given up, but, on the contrary, those which have been suspended are, for the most part, undergoing revival. The reason of this is, that the present possessors have entered by means of greatly reduced capitals, and on more favourable terms than their predecessors enjoyed. In the mean time, however, self-defence dictates to all parties the necessity of a most stringent regulation of quantities, viz., that the vend should be distributed through the several collieries upon such principles as to enable them all (as far as practicable) to make profit; but, under the numerous claimants for quantity, the amount allotted to each is found to be nearly fatal to the desired object.

The *probable duration* of this coal field was much canvassed by the parliamentary committees of 1829 and 1830. Mr. Hugh Taylor assigned to it a duration of 1727 years, at the then rate of consumption; and Dr. Buckland asserted that it would only last 400 years; though, at the same time, he admitted that his estimate was "vague and conjectural." The professor's opinion rested chiefly upon the assumption, that the coal field from South Shields to Castle Eden, lying beneath the magnesian limestone, was deficient of good coal; but it is worthy of remark, that since the doctor gave his evidence, coal of the first quality has been worked at the depth of 200 fathoms, beneath the said limestone.

Mr. Buddle estimated the average thickness of coal for the county of Durham at 25 feet 8 inches, and for Northumber land at 21 feet, which, taken together upon the comparative extent of each coal field, gave an average of 24 feet. Making allowance for all drawbacks, Mr. Taylor reduces this estimate to 8 feet as available mine; and yet this gives a duration of 1727 years; whereas, according to Professor Buckland's views, it would only require an available mine of *one foot ten inches* to endure the term of 400 years. Professor Thompson estimated the duration at 1000 years.

The extent taken by Mr. Taylor was from the mouth of the Coquet in Northumberland, to Castle Eden in the county of Durham, a distance of 48 miles; and the following are the respective depths at which the coal has been sunk to along the coast, viz.: —

NORTHUMBERLAND.		DURHAM.	
Coquet	80 fathoms.	South Shields	200 fathoms.
Cowpen	100 ,,	Monkwearmouth	263 ,,
Hartley	50 ,,	Murton winning	220 ,,
Whitley	60 ,,	Castle Eden	150 ,,

Moreover, those gentlemen, Professors Sedgwick and Buckland, earnestly argued against the policy of encouraging exportation; and also insisted on the necessity of government exercising an influence over the skreening, with a view of preventing the prevailing waste.

In the making of these estimates, a cubic yard of coal is taken to contain 7½ bolls, coal measure.

A great number of seams prevail in this extensive district, differing in section according to circumstances; but the following may be taken to be the standard working beds in each department:—

RIVER WEAR.

	Fathoms between.	Thickness. ft.	in.
Five-quarter	—	3	6
Main Coal	11½	6	0
Maudlin	11½	5	9
Low Main	10½	2	6
Hutton Seam	14	3	9
Beaumont Seam	22½	2	6

RIVER TYNE, WEST OF NEWCASTLE.

	fath.	ft.	in.
High Main	—	6	6
Crow Coal	10½	2	3
Five-quarter	3½	3	8
Townley Main	22	3	10
Stone Coal	15	2	9
Under 5-4 Coal	3½	3	4
Three-quarter	4	2	6
Brockwell	9	3	2

RIVER TYNE, EAST OF NEWCASTLE.

	fath.	ft.	in.
Monkton	—	2	10
High Main	112	6	0
Metal Coal	7	3	0
Yard Coal	17	3	0
Bensham	12	5	9
Six-quarter	15	2	6
Five-quarter	4	2	8
Low Main	6	5	6
Beaumont	28	2	10

The varieties of section in the Tanfield, Auckland, and Brancepeth districts, are too numerous to be particularized; but it may be worthy of observation, that, until lately, the southern outcrop of the Auckland coal field was taken to be situate at Raby Park; whereas recent investigations clearly exhibit it as continuing to the precincts of Barnard Castle, where the great and decided interference of the mountain limestone district takes place; and so prominent are the small seams of coal, that borings and driftings are now being carried on in the Duke of Cleveland's property, in hopes of finding workable beds.

Much might be said with respect to the qualities and characteristics of the various seams throughout this extensive district; but they may be summed up in general terms as follows:

The Main coals of the Tyne, Wear, and Tees, as also the Five-quarter and Hutton seams of the Wear, are, generally speaking, of prime, hard, caking quality, and most highly esteemed for domestic purposes.

The districts west of Newcastle, Chester-le-Street, and Durham, are, for the most part, soft coal, of pure quality, and very good for coking, gas, &c.

The coal to the northward of Newcastle, and the Low Main of the river Wear, are remarkably adapted for steam purposes.

*Mr. Richardson's Tables on the Composition of Coal (*1000*th Parts omitted), read before the Newcastle Natural History Society*, 1838.

Species.	Locality	Carbon.	Hydrogen.	Azote and Oxygen.	Ashes.
Splint -	Wylam - -	74.82	6.18	5.08	13.91
Do. -	Glasgow -	82.92	5.49	10.48	1.28
Cannel -	Lancashire -	83.75	5.66	8.04	2·55
Do. -	Edinburgh -	67.60	5.40	12.43	14.57
Cherry -	Newcastle -	84.85	5.04	8.43	1.67
Do. -	Glasgow -	81.20	5.45	11.92	1.42
Caking -	Newcastle -	87.95	5.24	5.42	1.39
Do. -	Durham -	83.27	5.17	9.04	2.52

Species.	Locality.		Quantity of oxygen necessary for the combustion of 100 parts of coal, minus oxygen in the coal.	Relative quantity of heat produced by the same weight of coal, Edinb. 100.	Relative quantity of heat given out by the same volume of coal, Edinb. 100.
Cannel	Lancashire	-	256.4	117.83	117.91
Do.	Edinburgh	-	217.6	100	100
Cherry	Newcastle	-	253.9	116.68	112.07
Do.	Glasgow	-	244	112.12	107.78
Caking	Newcastle	-	266.7	122.56	119.03
Do.	Durham	-	250.2	114.98	111.31
Splint	Wylam	-	240.1	110.34	108.99
Do.	Glasgow	-	250.5	115.12	114.15*

It is a curious fact, that the Northumberland and Durham coal field does not contain many descriptions of coal abounding in other parts of the kingdom, viz., the Blind Coal of Ireland and South Wales, the Splint Coal and Parrot Coal of Scotland, and the Cannel Coal of Lancashire.

The boundaries of the Newcastle coal field, already described, must not be confounded with the carboniferous limestone formation constituting the coal field of Berwick upon Tweed, and also the district to the westward of Corbridge, which consists of the succession of strata gradually cropping out on its western and northern rise, towards the mountain limestone of the lead mine district. Mr. Westgarth Forster published an account of this succession of strata, which is corroborated by the experience of practical viewers, and of which the following abstract may convey sufficient intelligence to the general reader. The section is given as vertical, and the depth reckoned to the bottom of the above strata.

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* The Lehigh anthricite in America contains—

Carbon	90.1
Water	6.6
Silex	1.2
Alumine	1.1
Oxyde of iron and manganese ..	.2
Loss	.8
	100

	Fathoms.
High Main, or Wallsend seam	70
Harvey's seam, or Beaumont	177
Brockwell, or lowest worked seam of Tyne	183
Millstone grit	200
Limestone, blue, 3 fathoms thick (lead bearing)	257
Coal, supposed to be that wrought at Acomb, Fourstones, Haltwhistle, and Blenkinsop	258
Hazle	260
Plate, and succession of hazles and plates down to the depth of	293
Iron-stone and coal	294
Firestone sill	296
Plate	315
Little limestone	316
Plate	319
Coal, sulphureous	320
Coal sill (high)	322
Plate	323
Coal, sulphureous	324
Low coal sill	325
Plate	329
Great limestone, 11 fathoms (lead bearing)	340
5-yard limestone	377
Tyne bottom limestone	420
Great whin sill, 14 fathoms	437
Great red freestone, 40 fathoms	682

The above is the theory of the stratification underneath the Newcastle coal field, as verified by the cropping out of the successive strata, and traceable especially by means of the limestones, plates, and whin sills, through a very great circuit of country; the Berwick coal field being understood to be similarly situated, and connected with this lower series of carboniferous rocks, which, at the collieries of Acomb, Fourstones, Haydon Bridge, and Haltwhistle, to the westward, are characterised as follows:—

At Acomb colliery,

At 24 fathoms, alternations of clay, shale, and sandstone.
4 do. further, little limestone.
1½ do. do., plate or shale.
1 do. do., coal, Acomb seam, containing good coal 3 feet, band 9 in., coarse coal 1 ft. 8 in., total 5 ft. 5 in.
1 do. do., plate and grey beds.
15 do. do., hazle and grey beds.
15 do. do., plate.
10 do. do., great limestone, 11 fathoms thick.

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The Berwick coal field, therefore, deserves to be mentioned before quitting this part of the subject. It is situated, as before stated, in the lower beds of the mountain limestone, which rests upon, and is interstratified with thick beds of ferruginous sandstone, underneath which again is a very regular and tolerable seam of coal, 4 feet thick, which was recently worked at Lamberton, 4 miles north of Berwick. Scremerston is the deepest explored part of the district, which, according to Mr. Winch's Geology, contains the following seams of coal, viz :—

	ft.	in.
The Muckle Howgate seam is the first workable bed on the Scremerston estate - - -	2	6
60 fathoms further, Caldside seam - -	3	0
36 do. do., Main coal - - - -	4	3
3 do. do., Stone coal - - - -	3	7
14 do. do, including alternations of shale, sandstone, and limestone, to Cancer coal (with bands) -	5	0
15 do. do., Three-quarter coal - - -	2	8
4 do. do., Cowper Eye seam - - -	2	6
14 do. do., Western coal seam - - -		
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From the gradual rise of the strata westward, the first four seams at Scremerston do not reach to Thornton, Shoreswood, Felkington, Etal, Gathrick, and Greenowalls (which collieries work the four lower beds) ; but there is considerable discrepancy in the classification.

From Berwick-upon-Tweed, along the sea coast to Lamberton, the stratification is, for the most part, singularly flat and regular, and constitutes so remarkable a section, that I may be excused for inserting it here.

	fath.	ft.	in.
Red freestone - - -	15	0	0
Black shale - - -	2	0	0
Blue limestone - - -	0	4	0
Coal - - - -	0	0	3
Marl - - - -	2	0	0
Red freestone - - -	4	0	0
Marly fire clay - - -	6	0	0
Freestone - - -	0	3	0
Fire clay - - -	0	3	0
Coal - - - -	0	1	2
Fire clay - - -	7	0	0
Red freestone - - -	1	1	0
Grey shale - - -	4	0	0
Red freestone - - -	1	0	0
Fire clay - - - -	1	1	0
Good coal - - -	0	3	5
Total -	45	4	10

At a short distance to the northward, an upcast trouble throws out. the freestones; and soon after, the clay slates intervene.

In addition to the above general outline, reference will be made in a future section to certain peculiarities belonging to this and to other coal fields.

In concluding these prefatory observations, I beg to mention and recommend to the attention of the public a Geological Map of the British Isles, just published, by my friend, Mr. Knipe, and which contains the most recent discoveries of the ablest geologists of the day.

SECTION II.

CHRONOLOGICAL HISTORY OF THE RISE AND PROGRESS OF THE COAL TRADE FROM THE YEAR 1200, INTRODUCTION OF VARIOUS IMPROVEMENTS, QUANTITY OF COALS EXPORTED, ETC.

Before proceeding further into the general subject of this essay, it may be interesting to give a statistical account of the progress of the trade, from the earliest period of its record; particularly as many of the historical data are necessarily interwoven with it, especially in respect to the introduction of improvements, the prices of coals, labour, &c.

1239. King Henry the Third granted to the good men of Newcastle licence to dig coals outside the walls thereof, and from thence to draw and convert them to their own profit, in aid of the fee-farm rent of £100 per annum.

1246. The coal, having become an article of export, obtained the name of sea coal.

1272. Henry III. granted a charter to the town of Newcastle.

1280. The revenue of the town had increased so much from the sale of coal, that it was worth £200 per annum.

1306. So great was the use of coals in London, that parliament complained to the king of their infecting the air with noxious vapours; in consequence of which, proclamation was made against their further use, " that not only in the city of London, but all havens, towns, and many places within the land, the inhabitants in general are constrained to make their fires of sea coal, or pit coal, even the chambers of honourable personages, and of necessity have devised the making of iron, glass, bricks, &c., with the said sea coal." Notwithstanding this, 10s. worth were used at the coronation of Edward III.

1325. A vessel is mentioned as having brought corn from France, and returned laden with coals.

1330. The priory of Tynemouth let Elswick colliery for £5 per annum, as also some others in the neighbourhood of Gallowgate.

1333. The coal mines of Collierly, in the parish of Lanchester, were wrought considerably.

1343. A coal mine is mentioned in the ordination of the vicarage of Merrington, county of Durham.

1354. There is a notice of the sinking of pits at Ferryhill, county of Durham.

1357. Edward III. made various orders regarding the measuring of coal, and regulations for conveying coals from Gateshead across the Tyne in boats, on condition that the usual customs of the port were paid; but coals were not allowed to be exported to any place out of the kingdom, except Calais.

1378. Keelers mentioned, and the vessels were called lighters.

1379. A duty of 6d. per ton every quarter of a year was imposed upon ships coming from Newcastle with coals.

1404. In the 5th statute Henry IV., hostmen are established, to provide for and entertain "merchants and aliens."

1421. Keels regulated to carry 20 chaldrons of 6 bolls each, at 2d. per chaldron king's duty, imposed on all coals sold to persons not franchised in the port of Newcastle.

1529. Cardinal Wolsey, bishop of Durham, was in the receipt of one chaldron of coals daily out of each coal mine within the domains of Gateshead and Whickham.

1530. Elswick colliery let for 25 years, at the rate of £20 per annum, on condition that not more than 20 chaldrons, of 6 bolls each, should be drawn in a day.

1536. Coals sold at Newcastle for 2s. 6d. per chaldron, of 6 bolls each; and at London for 4s. per chaldron.

1538. Two pits were let at Elswick for 8 years, at the sum of £50 per annum; and in this lease sufficient "way leve and staith leve" were provided for.

1539. Gateshead coal mines let.

1554. Queen Mary granted a lease of all the mines within the bounds of Elswick, at the annual rent of £68.

1577. Harrison's description of England contains notices concerning the coal trade. "Of coal mines we have such plenty in the north and western parts of our island as may suffice for all the realme of England; and so must they doe hereafter indeed, if wood be not better cherished than it is at this present. I dare affirm that if woods do go so fast to decay in the next hundred years as they have done and are like to do in this, it is to be feared that broom, turf, brakes, whins, ling, hassock, rush, &c., and sea cole will be good merchandise even in the city of London, whereunto some of them have already gotten ready passage, and taken up their innes in the greatest merchaunts' parlors."

1582. Queen Elizabeth obtained a lease for 99 years of the manors of Gateshead and Whickham, at the yearly rent of £90. This was called the Grand Lease, and caused an immediate advance in the price of coals. It was transferred to the Earl of Leicester, who assigned it to Sir Thomas Sutton, the founder of the Charter House, London. Sutton afterwards sold it to Sir W. Riddell and others, for the mayor and burgesses of Newcastle, for the sum of £12,000.

This lease was much complained of, on the score of monopoly; for whilst Sutton held it, the price in London was 6s. per chaldron; but on its assignment to the corporation of Newcastle, the price rose to 7s., and soon after to 8s. per chaldron of 6 bolls.

In the above year, the bishop of Durham let the coal under the manor of Whickham to Anderson and White, for 99 years, at £117 per annum.

1587. Further parliamentary provisions were made regarding the hostmen's regulations.

1590. The current price of coals in London was 9s. per chaldron, upon which the Lord Mayor complained to the Lord Treasurer Burleigh, setting forth that the society of free hostmen consisted of about 60 persons, who had consigned their rights of the Grand Lease to about 18 or 20, who engrossed the collieries of Stella, Ravensworth, Newburn, &c.; and he therefore requested that the whole of them might be opened, and the price fixed at a maximum of 7s. per chaldron.

1599. Queen Elizabeth demanded such great arrears of the coal duty, that the people of Newcastle, finding they could not pay, agreed to charge themselves and their successors with 1s. per chaldron. At this time the duty on coals exported beyond the sea was 5s. per chaldron. James I. revised the second duty; and his successor, in addition, fettered the trade with several arbitrary impositions.

1600. Queen Elizabeth granted a charter to the town of Newcastle, in which 48 persons are named, with power to load and unload at any part of the Tyne, and to pay 12d. per chaldron on all coals consumed within the kingdom. At this time, the coals were brought down in wains, holding 8 bolls each, all measured and marked at the staiths on the river. No waggon-ways were in use at this period; but maunds or panniers, carrying 2 or 3 pecks each, were used for horses.

1602. There were 28 acting fitters or hostmen, who were to vend by the year 9080 tons of coals, and find 85 keels for that purpose.

1615. The trade employed 400 sail of ships, one half of which supplied London, and the remainder the other parts of England.

In the latter end of the reign of Queen Elizabeth, the coal duty of the town of Newcastle, at 4d. per chaldron, appears to have brought to that corporation the sum of £10,000 per annum.

1624. Vended by the hostmen 14,420 tons. At this period, the French traded to Newcastle for coal, in fleets of 50 sail at once, serving the ports of Picardy, Normandy, Bretagne, and Bordeaux; whilst the ships of Bremen, Embden, Holland, &c., were supplying the inhabitants of Flanders with the same article.

In this year, proclamation was made for surveying the sea-coal of Newcastle, Sunderland, and Blyth.

1627. Previous to this period, a dreadful consumption of wood was going on, by converting it into charcoal, for the manufacturing of iron; but, in this year, a charter was granted to three persons, for the practice of a new invention of melting iron ore with pit coal and sea coal only,

1630. A patent for another new invention for manufacturing iron, lead, tin, and salt, as also the burning of bricks, tiles, lime, &c., with the fuel of peat and turf reduced to a coal, without the use of sea coal or wood.

In this year, a duty of 5s. per chaldron was laid on coals sent foreign, except to Jersey, Guernsey, and the Isle of Man; and 1s. 8d. over and above, on such as were exported by any Englishman or denisen.

1633. Price of coals at Newcastle, 9s per chaldron.

1634. The burgesses of Sunderland, anciently known as Weremouth, were incorporated by Morton, bishop of Durham; the export articles specified in the charter being sea coals, grindstones, rubstones, and whetstones.

1635. The price of coals was 10s. per chaldron.

1638. The king incorporated a company of monopolizers, Thomas Host and others, empowering them to buy all the coals produced in their district, by paying to the king 1s. per chaldron, and to sell them again in London at not exceeding 17s. per chaldron in summer, and 19s. in winter.

During the reign of Charles I., coals were brought into common use in London, at 17s. per London chaldron. 20,000 seamen were employed in the coal trade alone, out of 90,000 employed in Great Britain.

1640. The town fell into the hands of the Covenanters, by which the coal trade suffered an immense loss; for, previous to that time, it is said to have employed 10,000 people. Every one fled, thinking the Scots would give no quarter, so that the trade was put to a complete stand-still.

1642. In January, an ordinance from parliament prohibited ships from bringing coals from Newcastle, Sunderland, or Blyth; and succeeding restrictions made every species of fuel so scarce in London, that coals were sold at £4 per chaldron. It was declared "that no ship, barque, or other vessel, shall from henceforth make any voyage to Newcastle, for the fetching of coals or other commodities, until that town shall be reduced into such hands as shall declare themselves for the king and parliament."

During the civil wars, in consequence of Newcastle being under siege, the collieries on the Wear became objects of great importance, and Sunderland received a garrison from the parliament.

1643. The Marquis of Newcastle had ordered all the coal mines to be fired, but was prevented by Leslie, the Scotch general. Same year, the Commons of England made an order to restrain the price of coals to 20s. per chaldron, and not above 23s., in London.

May 12th, an ordinance was issued for free trade with the ports of Sunderland and Blyth, to relieve the poor inhabitants thereabout, in consequence of Newcastle having been blockaded.

June 5th, the citizens of London, having raised £100,000 for the purpose of contesting the possession of Newcastle, were to be repaid with 8 per cent. and one-third increase upon the subscriptions; and the Marquis of Newcastle being in possession of all the mines, parliament enacted a duty of 4s. per chaldron, to be paid by all ship-owners, in lieu of half the value of their shipping; and on consumers 10s. per chaldron, in lieu of a contribution of their whole year's consumption of coal. Newcastle was besieged 13th August in this year, and was taken by storm the 19th October, 1644.

1644. The House of Commons imposed a duty of 4s. per chaldron on all coals shipped coastwise, which continued till 1648, when it was abolished. In November, 1644, trade with Newcastle was re-opened for coals, salt, &c., "that corporation having been won with the sword by the Scots."

The collieries of Harraton, on the river Wear, were at this time the property of Mr. Hedworth, and had been leased for a mere acknowledgment to Sir W. Wray, of Beamish, "who being a papist and recusant convict, the colliery was sequestered, when it was valued at £3000 per annum, perhaps owing to the Tyne being shut against the rebel city of London."

1647. These collieries were leased under the state to George Grey, of Southwick, and George Lilburn; but, in 1649, they were seized by Sir Arthur Hazlerigg, then governor of Newcastle.

1648. Fuel was so scarce in London, that many of the poor were starved to death, which was attributed to Sir Arthur Hazlerigg, for his severe imposition of 4s. per chaldron, which was in consequence removed.

1649. Grey, in his Chorographia, records that "many thousand persons are employed in this trade. Many men are employed in conveying the coals in keels from the staiths aboard the ships. One coal merchant employeth 500 or 1000 in his works; yet, for all his labour, care, and cost, can scarce live by his trade. Nay, many of them have consumed great estates and died beggars. Mr. Beaumont, a gentleman of great ingenuity and rare parts, adventured £30,000 in our mines, who brought with him many rare engines, not known in our parts, as the art to bore with iron rods, to try the deepness and thickness of the coal, rare engines to draw water out of the pits, waggons with one horse to carry down coals from the pits to the staiths, &c.: within a few years he consumed all his money, and rode home upon his light horse."

Lord Keeper Guildford says that bulky carts are made, with four wooden rollers fitting the rails, whereby the carriage runs so easy that one horse will draw down 4 or 5 chaldrons, and is an immense saving to the coal merchants.

1654. Meetings took place amongst the keelmen of Newcastle, for an increase of wages. About the same period, the town of Sunderland began to rise into great importance.

1655. Coals sold in London for 20s. per chaldron; and the Tyne trade employed 320 keels, each of which conveyed on board ship 800 chaldrons per annum, coal measure.

1656. Coals raised at Newcastle from 10s. to 12s. per chaldron. The coal mines of Mr. Clavering were at this time working within 2 miles of Tynemouth, supposed to be at Whitley.

1658. Commissioners were appointed for the more accurate measurement of keels.

1660. The coal trade was becoming attractive, and consequently many new adventurers came in.

1661. A petition was sent from the hostmen of Newcastle to impose a duty of 1s. per chaldron on coals exported from Sunderland, which town was fast growing into rivalry.

1662. A petition was sent to parliament, prepared by 2000 colliers, against the injustice of their masters; but a redress of grievances rendered the interference of the legislature unnecessary.

1663. A duty of 1s. per chaldron was laid on coals vended coastwise, from which the revenue was estimated to be worth £8000 per annum, viz., on 160,000 chaldrons.

So important had the shipment of coals from the river Forth become, that an act of parliament made the Culross chaldron the standard measure of the kingdom.

1666. The hostmen of Newcastle imposed a duty of 1d. per chaldron on all coals cleared at the custom-house, in order to support the men laid off work at the collieries, which had been laid in on account of the war, and great quantities of coal remained on hand unsold.

1667. Coal pits were open on Stella Grand Lease, and numbers of dead bodies were thrown in during the border wars.

By an act of parliament passed after the great fire of London, a duty of 12d. per chaldron was granted to the lord mayor and others, to enable them to rebuild the city. This duty was to continue till 1677; but not being found sufficient, it was increased to 3s. per chaldron, to continue till 1687.

1670. Parliament also imposed a duty of 2s. per chaldron on sea-borne coals imported to London, from the 1st May, 1670, to the 24th June, 1677, and 3s. per chaldron from the last date to the 29th September. Three-quarters of the money raised by the former act, and one-half of that raised by the latter, were to be employed in rebuilding 52 parish churches, and a quarter of this one-half was to be applied exclusively to the rebuilding of St. Paul's.

1671. Waggon-ways and waggons were in use at Ravensworth colliery.

1673. Benwell and Fenham collieries on fire. The Main Coal of the Town Moor had been burning for 30 years.

In this year was published a work called "The Grand Concern of England," wherein the author complains of the high price of coals in London, which he states as follows:—Per Newcastle chaldron, 7s.; freight, 6s.; city dues, 3s.; lighterage, wharfage, and cartage, 4s.; total, 20s. "If then," he adds, " 3 Newcastle chaldrons, computed at £3, make 5 London chaldrons, to be sold at £5, 10s., there is very *nigh half in half* gotten thereby."

1676. Lord Guildford, speaking of way-leaves, says, " When men have pieces of ground between the colliery and the river, they sell leave to lead coals over their ground so dear, that the owners of a rood of ground expect £20 per annum."

At this time, Sir W. Petty estimated the coal shipping of Newcastle at 80,000 tons, of which a considerable part was foreign built.

1677. King Charles II. granted to his natural son, the Duke of Richmond, and his heirs, the reversion of the 12d. per chaldron on coals, at the yearly rent of £1836, 2s. 6d., and also another rent of £613, 17s. 6d., yet subject to a payment of £500.

1685. A parliamentary duty of 5s per ton was laid upon all foreign shipping, founded upon the serious decay of ship building at Newcastle, Hull, Yarmouth, and Ipswich.

1690. Winlaton iron works founded, on account of the proximity of coal proper for manufacturing. They were commenced by Sir Ambrose Crowley, Knt., draper and alderman, in London, and employed at one time 1500 people.

At this period, Whickham colliery was worked ; and as waggon-ways were not introduced, upwards of 600 wains were employed in leading the coals to Derwent Gut.

1693. The bishop of Durham let Blackburn Fell to Sir J. Clavering and Thomas Liddell for £40 per annum ; the coals being led in carts to Swalwell, and afterwards by waggons to Dunston.

About this period, waggons were first used upon the river Wear at Allan's Flatts colliery.

1695. An export duty of 5s. per chaldron of 36 bushels Winchester laid upon coals sent from England ; and 5s. per ton upon all coals sent from Scotland, in addition to former duties.

From this period, the duties have been too numerous and fluctuating to particularize, they were then as follows :—

	PER TON.	
	s.	*d.*
In Newcastle, town dues 2d., coast duty 1s. 4d.—1s. 6d.	0	9
Paid in London per London chaldron, king's duty 9s. 4d., war taxes 3s. 2d., metage 8d., orphans' duty 6d., market dues 1d. - - -	13	9
Lord mayor's dues ¼d., and Trinity dues 1d. per Newcastle chaldron, in all - - -	0	0¾
Total per London chaldron	14	6¾

1699. The trade at this time shipped 300,000 Newcastle chaldrons, annually, to London, of which two-thirds went from Newcastle; the oversea trade at the same time employing about 90,000 tons of shipping.

1700. The principal seats of the coal trade of the river Tyne above bridge were, the staiths situate at Team Gut and Dunston, Derwent Haugh, Stella, Bell's Close, and Lemington, where were delivered the coals of Pontop, Marley Hill, Tanfield Moor, Garesfield, Gibside, Axwell, Blaydon Main, Stella Grand Lease, Hedley Fell, Chopwell, Throckley, Wylam, Walbottle, Newburn, Denton, Fenham, Bell's Close, Benwell, and Elswick; and below bridge was shipped the produce of the collieries of Heworth, Gateshead, Felling, Tyne Main, Byker, Jesmond, Heaton, and St. Lawrence.

The river Wear was principally supplied from the collieries of the Lambton and Tempest estates, the districts up Chester Burn, Chartershaugh, Fatfield, Birtley, &c., all delivered into keels at the neighbouring staiths, extending all the way from Coxsgreen to Chartershaugh.

From the state of the trade, it was necessary to hold, from time to time, large stocks of coals, in order to give dispatch, to suit tides, and meet other emergencies. Hence those extensive erections called staiths, many of which remain to the present day.

1701. The best coals sold in London for 18s. 3d. Deductions:—King's duty, 5s.; St. Paul's ditto, 1s. 6d.; metage, 1s. 6d.; in all 8s., leaving 10s. 3d. At Newcastle, good coals sold for £4 the keel of 15 chaldrons; in the Pool of London, 5s. 4d. per chaldron; at the same time, they were sold per Newcastle chaldron, 11s.; and there were employed in the Tyne from 1500 to 1600 keelmen.

1703. The Masters of the Trinity House asserted, that 600 ships, one with another, of 80 Newcastle chaldrons, with 4500 men, were requisite for carrying on this branch of commerce, which they said was the rate for the last three years.

The following table includes the coal prices from 1395 to 1703 on board ship at Newcastle:—

Years.	Per chaldron.			Where sold.
	s.	*d.*		
1395	3	4	(6 bolls)	Whitby Abbey.
1512	5	0	best	Alnwick Castle.
ib.	4	2	inferior	Do.
1536	2	6		Newcastle.
ib.	4	0		London.
1550	12	0	per load	Do.
1582	6	0*		Do.
1585	8	0*	(8 bolls)	Do.
1590	9	0*		Do.
1626	7	6		Newcastle.
1633	9	0		Do.
1635	10	0		Do.
1637	17	0†		London.
ib.	19	0		Do.
1644	80	0	Siege of Newcastle	Do.
1653	10	0		Newcastle.
1655	20	0‡		London.
1656	12	0		Newcastle.
1667	30	0§		London.

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* The advance of price in these years was attributable to the Grand Lease.

† This was the year when the grand monopoly flourished.

‡ In this year it was agreed that 136 Newcastle chaldrons should equal 217 London ones.

§ The maximum fixed by act of parliament.

Years.	Per chaldron. s.	d.		Where sold.
1701	18	3	- - -	London.
ib.	10	6	- - -	Newcastle.
1703	11	0	- - -	Do.

1710. During the last four years, the average annual export of coals from the port of Sunderland was 65,760 Newcastle chaldrons; and from the Tyne, the average of the last six years was 178,148; making a total average export of 243,908 chaldrons.

In this year, Bensham colliery exploded, whereby 75 persons lost their lives; and here it was that the first Low Main seam was wrought

The scale of keel dues on the Tyne was fixed in 1710 as follows:—

	s.	d.	
A vessel above Ouseburn .	6	4	per tide.
„ below do. - -	6	8	„
„ at Snawdon's Hole -	7	6	„
„ at St. Anthony's -	7	8	„
„ at Wincomlee - -	9	0	„
„ at Jarrow and Howdon	11	8	„
„ at Shields - -	13	4	„

1714. The first steam-engine north of the Tyne was erected at Byker. The engineer was the son of a Swedish nobleman living at Newcastle.

1721. Steam-engines were in common use in this district, for the purpose of drawing water.

The expense of a dinner to 29 hostmen at this period will illustrate the character of the times:—"3 doz. and 4 bottles of French claret, £5; 6 quarts and 1 pint white wine, 13s.; punch, 6s. 4d.; 3 bottles hock, 7s. 6d.; 1 quart sack, 2s. 6d.; tobacco, 1s. 6d.; news, 6d.; eating, £2, 10s.—Total, £9, 1s. 4d."

1725. Upwards of 700 wains were employed in leading Jesmond coals down to the Ouseburn; the water being drawn from the colliery by means of horse engines.

Elswick engine was erected upon Elswick quay, for the purpose of working the Low Main, which was continued through into West Montague, and also Benwell and Fenham. It rose out to day at Denton Burn and Scotswood ditch. From 600 to 700 carts were employed in leading these coals down to Scotswood quay; and 300 or 400 pitmen were employed, who resided at Benwell village.

1727. Tanfield Arch built, for a colliery waggon-way.

1727. The coal-owners of the county of Durham entered into an agreement for 7 years, not to sell their coals for less than 11s. 6d. per chaldron.

1748. So much had the Sunderland trade increased since 1710, that in this year the Wear vend was 147,403 chaldrons.

1761. Mr. Smeaton calculated that the effective power of the best pumping engines was 7 ℔. per inch; and that when the cylinder is about 18 inches, ten 6-feet strokes per minute may be effected. He calculated that a 24-inch cylinder could be worked by one bushel of Newcastle coals per hour.

1763. The cylinder for Walker colliery arrived from Colebrook Dale; diameter 72 inches, length of stroke 10½ feet; being the largest in the north of England.

In this year, an explosion occurred at Fatfield colliery, by which 15 persons were killed. Upon this occasion, the first steel mills used in this part of the country were brought from Whitehaven, where they had been invented by the ingenious Mr. Spedding some short time previous.

1764. The trade from the Tyne had increased coastwise 20,000 chaldrons London measure, and 40,000 like measure into foreign parts; and in this year, 3727 vessels cleared from this river to the coast, and 365 to foreign parts, all coal laden.

1756. Denton colliery won by Edward Montague, Esq.; the coal said to be equal in quality to Long Benton, then worked out.

1768. Tanfield Moor colliery, the property of the Hon. the Earl of Kerry, won; the coals to be led to Derwent Haugh staith.

A minute from the books of the late Mr. W. Brown, of

Throckley, gives the following list of engines at work drawing water in 1769 : —

	No.	Diam of cylind.
Elswick	2	28 27
Jesmond	4	
Byker	6	42 42 60
Heaton	4	
Benton	5	60
Tynemouth Moor	4	60 42 75 70
Plessey	1	32
Choppington	1	16
Black Close	1	13
Eshott	1	
Felkington	1	20
Duddingston, N. B.	1	66
Borrostowness	2	
Newbiggin	4	42 42 44 60
Hartley	2	42 62
Unthank	1	36
Chirton	1	43
Walker	2	73 72
West Denton	2	36 38
East Denton	1	60
Benwell	1	75
Lemington	1	42
Auckland	1	48
Nottingham	1	60
Norwood	1	13
Shilbottle	1	42
Newburn	1	
Throckley	4	36 13 48 60
Wylam	2	47 60
Gosforth	1	
Workington	1	28
Grey Southen	1	24
Whitehaven	4	28 36 42 42
Parton Do.	1	42
Bushblades	2	42 52
Rise Moor	1	60
Ouston	1	48
South Moor	1	47
Ravensworth	3	48
Gateshd. Fell	1	
Salt Meadows	1	32
Heworth	2	52 72
North Biddick	2	62
Washington	2	62
Chartershaugh	1	36
Lambton	2	42 64
South Biddick	2	
Newbottle	2	36 48
Pensher, Tempest	2	
Morton Hill	2	
Black Fell	1	
Chester Burn	1	28
Fatfield	2	62 47
Fallowfield lead mine	1	42
In all	99*	

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* Of course these engines were exclusively applied to the drawing of water, and were of the Newcomen principle. injecting into the cylinder, and working purely by the atmospheric pressure, equal in effect to about 5 lb. per square inch upon the piston.

1770. About this period, wooden skreens were introduced.

1772. The state of the coal trade of the Tyne was as follows:—5585 ships left the port, with 330,200 tons of coals.

The only best coal colliery below bridge at this period was Walker.

1775. Willington colliery won by Messrs. Bells and Brown.

1776. On an average of six years, the result was as follows:

Chaldrons cleared at Custom-house at Newcastle to	
London	260,000
Other British ports	90,000
British colonies	2,000
Other foreign parts	27,000
In all	379,000

The wages of seamen at this period were £3, 10s. per London voyage.

1778. A new machine for drawing coals was erected at Willington colliery.

1779. Felling colliery won by Charles Brandling, Esq.; and Waldridge colliery by W. Joliffe, Esq.

1780. Died, at Gateshead, Baron Von Hauke, a native of Silesia, who had come hither for the purpose of extracting tar from coal.

1783. So oppressive was the evil of impressment for the sea service upon the keelmen of the river Tyne, that 798 purchased protections from government.

1784. An act of parliament, after referring to other acts passed by Queen Anne in 1711, and also in 1730, against the combination of coal-owners, lightermen, and masters of ships, enacts that in case of any number of persons, above five, buying and reselling coals, they shall be deemed guilty of unlawful combination to advance the price of coals, and liable to be punished by indictment.

Notwithstanding the infancy of the coal trade, the following statement of the vend of the river Wear, in the year 1784, will show that individual collieries in those days were in a much better position than at present:—

	Newcastle Chaldrons
Lord Ravensworth and Co., Black Fell	19,238
Sir J. Eden, Beamish - -	16,120
Lambton collieries - -	41,247
Tempest ditto - - -	31,001
W. Peareth, Esq., Chartershaugh, &c.	21,746
Hudson, North Biddick - -	17,028
Oxclose - - - -	13,579
Sir R. Milbank, Bart., Fatfield -	17,533
J. Nesham, Esq., Newbottle -	13,997
W. Russell, Esq., Washington -	14,608
H. Joliffe, Esq. - - -	12,167
Humble and Co., Leefield - -	10,097
Biss and Allan, North Biddick -	894
South Biddick - - -	15,230
Total -	244,485

In 1789, Mr. Beaumont said that the quantities of coals annually exported were as follows:—

	Newcastle Chaldrons.
To the Dutch United Provinces -	50,000
To France and Flanders - -	20,000
To Denmark - - -	10,000
To Hamburgh - - -	10,000
To Sweden and Portugal - -	5,000
To Russia, Norway, &c. - -	5,000
	100,000

Newcastle coals were at that time 18s. 6d. per chaldron on board ship, and Scotch coals 18s. 11d.; and Mr. B. adds that the Newcastle coals were reckoned 2s. per London chaldron better than the Scotch.

At this period, "both ships and collieries were a dreadfully losing trade," the primary cause being too many mines working at one time; whilst the profits were reaped by the merchants in London, who got 1s. per Newcastle chaldron premium, which, on the quantity sent from England and Scotland, amounted to £20,000 per annum.

The result of sending coals to London then was as follows, per London chaldron :—Coal-owner's charge, 8s. 6d.; duties, 12s.; freight and expenses, 10s. 6d.; coal buyer's profit and expenses, 6s.; total, 37s.

The expense of raising coal was stated thus, per London chaldron :—Labour, horses, and other expenses above and below ground, 3s.; leading and staith, 1s.; upholding waggonways and waggons, 1s.; way leave, staith rent, and expenses, 6d.; agency, 8d.; fittage, 8d.; premium to coal buyer, 6¼d.; tax, river Tyne, 6¾d.; total, 7s. 10½d., which, deducted from 8s. 6d., leaves 7½d. per London chaldron profit, upon an average vend of 10,000 Newcastle chaldrons, exclusive of repayment of capital sunk in winning, &c., which would require 20 per cent. per annum to reimburse capital and interest.

1790. The principal scene of the operations of the trade had at this period greatly changed. The collieries delivering at Derwent Haugh had mainly declined, as well as those at Throckley, Team, Dunston, &c. The distant collieries of the Wear, too, had given place to those nearer to the place of shipment. The monopolists were seeking to get rid of many of their distant bargains, and the whole state of matters foreboded an unlooked-for revolution, arising partly from the increasing desire of large capitalists to invest their money in the high-priced coal of the deep collieries. The eastern limits of the coal field seemed still to be bounded by the magnesian limestone, which appeared to give an assurance that from the east further competition could not arise; whilst the expense of leading by private railways the distant soft coals lying to the westward, seemed equally to insure against competition from that quarter.

1795. Up to this period, the pillars of the deep collieries below bridge were given up as lost; but the robbing of them was now introduced by the late Mr. Thomas Barnes, to the taking of one-fourth of what remained, viz., one-half of every alternate pillar. This plan was shortly afterwards followed at Bigge's Main, Wallsend, &c.

1800. The prices of coal were again advanced 2s., making Tyne coals 20s. 6d., and Wear ditto 18s. The cost on board ship, including all charges, was at Newcastle 26s. 5d., and at Sunderland 25s. 9d. From Mr. Ismay's statement before parliament, the cost of producing coals had increased, from 1792 to this period, 3s. 11¼d. per chaldron. The relative vends at the two periods were—

	Chaldrons.		Chaldrons.
1792, from the Tyne,	457,427	1800, from the Tyne,	685,280
the Wear,	287,738	the Wear,	303,459
	745,165		998,739

To show the extraordinary fluctuation of prices in London, during these periods, it is enough to state, that in 1794 coals were 44s. 1d. per London chaldron; in 1799, 57s. 1d.; in 1800, 60s. to 70s.; and in December, 1799, during a temporary scarcity, they were sold so high as 73s. 6d.

1804. Before this time, a custom of giving two or three guineas per hewer, as binding or bounty money. had crept into the trade; but in consequence of an extraordinary demand for coals having taken place during the year, and the collieries of Sir H. Vane Tempest at Pensher and Rainton having become greatly extended under the exertions of Arthur Mowbray, Esq., a general scramble for hewers and putters took place at the ordinary binding time. The fears of procuring the necessary supply of men were industriously magnified to such a degree, that from twelve to fourteen guineas per man were given upon the Tyne, and eighteen guineas upon the Wear; and progressive exorbitant bounties were paid to putters, drivers, and irregular workmen. Drink was lavished in the utmost profusion, and every sort of extravagance perpetrated. Nor did the evil end here; for a positive increase in all the rates and wages was established, to the extent of from 30 to 40 per cent.

The consequence was the bringing into the trade of a great number of labourers and their families, who had hitherto never thought of pit work. The most extravagant habits were generated by the exorbitant wages; and an unnatural impulse was given to the trade, which, in due time, brought about a ruinous result, the effects of which are yet far from being eradicated, because the struggle for pre-eminence has uninterruptedly continued ever since.

The evil effects of the system of binding money also produced a re-action, so that it was very soon after discontinued; and, for many years, the only expense has been two shillings to men, and one shilling to boys, accompanied with gradual and material reductions upon all sorts of labour, to about the standard of the year 1800.

1810. Mr. Bailey, in his Agriculture of Durham, enumerates 34 water-sale collieries in that county, which at that time vended annually 1,333,000 chaldrons of 36 bushels, and employed 7011 men. In the same district, he was informed, there were also 35 landsale collieries, vending 147,080 chaldrons of 36 bushels each, and employing 382 men. "The keelmen on the Wear amount to 750; casters, trimmers, and fitters to 507; and as the coals carried to the Tyne are nearly in the ratio of 8 to 5 of those carried to the Wear, the men employed on the Tyne will be about 2,000; so that from this calculation, it appears that the total number of men employed in the above capacities, in the county of Durham, is, in the proportion, of 10,650 to 148,080 thirty-six bushels chaldrons of coals; besides the employment it gives indirectly to an immense number of artificers, of various descriptions, of which no account can be had."

From Mr. Bailey's tables it also appears, that the water-sale collieries of Durham annually send to the Tyne about 701,000 thirty-six bushels chaldrons of coals, and employ 3265 men in mining them.

The Newcastle coal trade may also be conjectured to employ 6530; it makes the coal trade of Blyth, Hartley, Newcastle, and Sunderland to give employment to 9724 pitmen.

In 1810, the better to regulate the turns of vessels loading coals in the port of Newcastle, the "Night Office" was established, by parliamentary enactment, for the registering of vessels as they claimed their turn. In 1817, the office was removed from Newcastle to Shields, for better convenience.

In 1810, the binding of pitmen was removed from the long-accustomed term of October to the 5th April. The chief cause was, that as October was the period of the greatest trade, and when the stocks of coals were accumulated in the different markets, a strike or stoppage at that period was extremely inconvenient and objectionable. In October of the same year, a general strike took place, to have the binding time re-altered to October; but as the owners did not consent, law was had recourse to, and many hundreds of pitmen were at one time immured in jail.

Abstract of Coals exported from Sunderland during six Years, ending Christmas, 1810, *viz.*:—

Year.	Coastwise.	Foreign.	Total.
1805	313,307	5,958	319,265
1806	306,552	2,622	309,174
1807	291,317	4,274	295,591
1808	348,938	2,058	350,996
1809	324,455	973	325,428
1810	370,712	1,919	372,631

1815. It was calculated, upon the average of 33 engines, that for every bushel of coals consumed in the drawing of water, 21,500,000 ℔. of water were raised one foot high; and that, in some collieries, 18 times as many tons of water were drawn as of coals.

In this year, an inundation took place in Heaton colliery, whereby nearly 90 lives were lost. The waters of old Heaton and Jesmond collieries, which had been abandoned upwards of 70 years before, were thus let in, owing to the want of plans shewing the extent of the old workings. The exploring drifts of this colliery had been subjected to the process of boring for many years; but, in this instance, some inadvertence had taken place, which caused the disaster, affording a melancholy argument for the necessity of recording plans.

1816. On the 1st of January in this year, the first safety lamp invented by Sir Humphrey Davy was put to use at Hebburn colliery; and so simple and effective was it in form and principle, that it has, up to this moment, scarcely undergone any material alteration.* But, as many of the gases have been subsequently analysed, it may be interesting to insert here Dr.

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* The nature of the fire-damp and the application of the lamp, were thus described in Sir H. Davy's letter of October 15, 1815:—

"The fire damp I find, by chemical analysis is, as it has been always supposed, a hydro-carbonate. It is a chemical combination of hydrogen gas and carbon, in the proportion of 4 in weight of hydrogen, to 11½ of charcoal.

"I find it will not explode unless mixed with six times its volume of atmospherical air, and it *will not explode* when mixed with fourteen times its volume of air. Atmospherical air, when rendered impure by the combustion of a candle, but in which the candle will *still burn*, will not explode the gas from the mines; and where a lamp or candle is made to burn in a close vessel, having apertures only above and below, an *explosive mixture* of gas admitted *merely enlarges* the light, and gradually extinguishes it without explosion. Again, the gas mixed in any proportion with common air, I have discovered, *will not explode* in a *small* tube, the diameter of which is less than ⅛ of an inch (or even a large tube), if there is a mechanical force urging gas through this tube.

"Explosive mixtures of this gas, with air, require much stronger heats for their explosion than mixtures of common inflammable gas. *Red hot charcoal* made so as not to flame, even if *blown up* by a mixture of the mine gas and common air, does not explode it, but gives light in it; and iron, to cause the explosion of a mixture of this gas with air, must be made white hot.

"The discovery of these curious and unexpected properties of the gas, leads to several practical methods of lighting the mines without any danger of explosion.

"The first and simplest is what I shall call the *safe lamp*, in which a candle or a lamp burns in a safe lantern which is air tight in the sides, which has tubes below for admitting air, a chamber above, and a chimney for the foul air to pass through, and this is as portable as a common small lantern, and not much more expensive. In this the light never burns in its full quantity of air; and, therefore, is more feeble than that of the common candle, but not much, and it becomes extinguished by the *fire damp*, when it is so mixed with air as to be explosive by a common candle.

"The second is the *blowing lamp.*—In this the candle or lamp burns in a close lantern, having a tube below, of small diameter, for admitting air, and which is thrown in by a small pair of bellows; and a tube above, of the *same* diameter, furnished with a cup filled with oil. This burns brighter than the *simple safe lamp*, and is extinguished by explosive mixtures of the fire damp. In this apparatus, the candle may be made to burn as bright as in the air; and, supposing an explosion to be made in it, it cannot reach into the external air.

"The third is the piston lamp, in which the candle is made to burn in a small glass lantern, furnished with a piston so constructed as to admit of air being supplied, and thrown into it without any communication between the burner and the external air. This apparatus is not larger than the steel mill, but it is more expensive than the others, costing 22s. to 24s.

Turner's analyses of fire-damp from the coal mines of Newcastle upon Tyne, read before the Newcastle Natural History Society in 1838 :—

	Specific gravity.		Marsh Gas.	Air.	Nitrogen.	Carbonic Acid.
	Observed.	Calculated.				
1. Bensham seam, Wallsend	0.6024	0.5991	91	9	0	0
2. Yard coal, Burraton -	0.600	0.5903	93	7	0	0
3. High main, Killingworth	0.6196	0.6236	85	8	7	
4. Low main, do. - -	0.8226	0.8325	37	46.5	16.5	
5. Hutton seam, Pensher, 125 fa.	0.966	0.9662	7	82	11	
6. Do., Eppleton, 175 fa.	0.747	0.7677	50	6	44	
7. Do., Pittington, 45 fa.	0.866	0.8755	28	67.5	4.5	
8. Main coal, Hetton, 100 fa.	0.78	0.7724	50	23	27	
9. Bensham coal, Jarrow, 174 fa.	0.6381	0.641	81.5	18.5		
10. Jarrow, 11 fa. lower	0.6209	0.6079	89	11		
11, Bensham s., Willington, 145	0.7278	0.7175	68	28.7	0	3.3
12. Unmixed air - -	1	1	0	100		

In 1816, Mr. James Ryan, from Dudley, obtained from the Society of Arts the gold medal and 100 guineas, for his method of ventilating coal mines. On Mr. Ryan's system, "the draught, instead of sweeping through the whole mine, operates

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"Those lamps are all extinguished when the air becomes so polluted with fire damp, as to be explosive; but there is a fourth lamp, by means of which any blowers may be examined in air in which respiration can be carried on: that is the charcoal lamp.

"This consists of a small iron wire cage, on a stand containing small pieces of *very well burnt* charcoal, blown up to a *red heat*. This light will not inflame any mixture of air with fire damp.

"Of these inventions, the *safe lamp*, which is the simplest, is likewise the one which affords the most perfect security, and requires no more care or attention than the common candle, and when the air in mines becomes improper for respiration it is extinguished, and the workmen ought immediately to leave the place till a proper quantity of atmospheric air had been supplied by ventilation.

"I have made my experiments on these lamps with genuine fire damp, taken from a blower in Hebburn colliery, collected under the inspection of Mr. Dunn, and sent to me by the Rev. Mr. Hodgson. My results have been always unequivocal.

"I shall immediately send models of the different lamps to such mines as are exposed to danger from explosions, and it will be the highest gratification to me to have assisted by my efforts a cause so interesting to humanity.

"Signed, Humphry Davy."

directly upon the headway or passage which is excavated round the exterior of the mine, for the purpose of drawing off the gas from the interior workings." Although, in the opinion of practical viewers, his schemes were entirely visionary, yet, to satisfy the public mind, Messrs. Buddle and Hill, and the Rev. J. Hodgson, had been sent to Staffordshire in 1815, to report upon his system; and their report was entirely condemnatory of his views and propositions. His printed projects seem also to have found their way to Belgium, where, being less tested, they have found a much more important place in mining records than they have done in this country.

1820. The cost of coals from the Pool to the consumers in the city, was 14s. 8d. per chaldron, being more than the average price charged by the coal-owners, according to evidence given before a committee of the House of Lords; over and above which, there was a government duty of 6s. per chaldron.

1826. The Pitmen's Union was founded, for the procuring of higher wages.

1827. Gosforth winning was effected to the depth of 188 fathoms, having passed through 140 alternations of strata, of which 43 were seams of coal. It is remarkable as being sunk upon the south or rise side of the great downcast dyke of upwards of 100 fathoms; the field of coal to the northward being won by means of stone drifts into the Main Coal seams.

1828. The Sunderland trade comprised 9 or 10 collieries, with a capital of £700,000; and 700 collier vessels were employed.

The progress of the trade will appear by the following statement of Newcastle chaldrons exported:—

	SUNDERLAND.		NEWCASTLE.	
	Coast.	Foreign.	Coast.	Foreign.
1810	370,712	1,910	632,299	17,253
1820	415,972	14,425	756,513	44,826
1828	509,567	22,941	725,082	59,325

1829. Newcastle was the second port in the kingdom, having 987 ships = 202,379 tons; and Sunderland had 624 ships = 107,628 tons; being an increase of more than 100 per cent. in half a century.

1831. Wallsend colliery was exhausted in the Main Coal, the working of which was commenced in 1778, and which consisted of nearly 1200 acres.

In March this year, a general strike of the pitmen of the district took place, whereby they accomplished a very considerable advance of wages. The underground workmen of 47 collieries assembled upon Newcastle Town Moor; the alleged grievances being principally connected with the penalties contained in the bonds. Great efforts were made, upon this occasion, to cement a general Union; and where persuasion failed, intimidation was had recourse to.

1832. The pitmen, feeling a confidence in their Union, and lacking the prudence to be content with the advantages they had gained during the last year, in March commenced a more general and formidable strike; and as all attempts to reason with them failed, the coal-owners proceeded to turn out a great number of families, and supplied their places with miners and colliers, brought, at enormous expense, from all quarters of the country. Riots took place; and it was found necessary to locate police and soldiery at every colliery, to defend those persons who were desirous of working. A person was shot at Hetton; and, on the 11th June, Nicholas Fairless, Esq., a magistrate of South Shields, was murdered upon Jarrow Slake, for which William Jobling was afterwards tried and executed.

The consequences of this strike were alike detrimental to the pitmen, to the coal-owners, and to the general trade of the country; for the exertions of the coal-owners brought in an accumulation of labour from the lead mines and elsewhere, which laid the foundation of that overplus which has since produced so fatal a re-action, in the downfall of prices, and the superabundant supply both of labour and of coals.

1833. There were 13 collieries on the line of the Stockton and Darlington railway, from Witton Park to the river Tees.

1835. The Tees possessed 12 collieries, some of them situated 25 miles from the place of shipment.

1844. *Patent Fuel Company.*—The present year has ushered in the establishment of a Patent Fuel Company, the patent for which has been purchased by Mr. Wylam of Gateshead, who, with Messrs. Bertram and Parkinson, have expended a large sum in preparing to manufacture it. The process consists of boiling peat and coal tar together, in about equal quantities; the composition, when cold, is ground to powder, which is taken to a table whereon small coal is lying, heated to a temperature of about 250 deg.; about 10 per cent. of the powder is mixed with the coal as a flux; and when the materials are intimately combined, the moulds are filled, and placed in hydraulic presses, under a pressure of 10 tons, converting the matter into the form of a brick, and of about the same specific gravity as coal.

The advantages of this fuel are stated to be as follows:—

1. *Stowage.*—That it will only occupy three-fourths of the stowage that ordinary coal does; inasmuch as a ton of this fuel can be packed in 30 cubic feet, whereas a ton of ordinary coal requires 45 feet, which, together with the increased heat, amounts to a saving of stowage of from 40 to 50 per cent.

2. *Combustion.*—It emits, in burning, a long tongue of whitish flame, of great intensity of heat; is free from sulphureous vapour; and with a residuum of only 8 ℔. per ton of unavailable matter, in the form of a clinker, which passes in small globules from the furnace without amassing.

3. *Moreover*, it is stated to contain an increased combustion of about 25 per cent., viz., that 15 cwt. of this fuel is equal to a ton of coal.

4. *Weight.*—The fuel is moulded in the shape of a brick, 13 inches by 6 and by 4, weighing about 13 ℔. each, and is utterly free from breakage, capable of withstanding 500 deg. of heat without softening, and will neither fall nor dissolve by exposure to wet.

The produce of the different coal fields of the district may now be classified as under, with their assumed values on board ship:—

1. Best household coal, the produce of the country around Houghton-le-Spring, Coxhoe, Bishop-Auckland, Gosforth, Willington, &c., per Newcastle Chaldron - -	26s. to 30s.
2. Secondary, produced generally through the district - - - -	21s. to 24s.
3. Soft coal, for common purposes, steam-engines, lime-burning, coke, &c. - -	14s. to 18s.
4. Best steam-coal, around Cramlington, &c.	20s. to 22s.
5. Screened small - - -	5s. to 10s.

Such were the legitimate values, when real sales were obtained; but so great is the pressure upon the respective markets, under freighted ships and forced sales, that scarcely any *bona fide* prices can be obtained. Hence the great depression and loss of capital, which is now harassing every branch of the trade, and, as in the manufacturing districts, overtaking the labouring classes, with low wages and scanty employment. New markets are looked for with anxiety, but in vain; and the natural depression has been still further increased by the impolitic measures of government, in re-enacting an export duty of 2s. per ton upon all coals sent to foreign parts; the result of which has been most injurious to the proprietors of that class of coals mainly used for steam-engines, as this tax cannot do otherwise than operate as a bounty upon the competing coals of other countries.

The extraordinary consumption of coal in the home and continental steam-boats, which began to expand itself about the year 1825, created an immense excitement in the district around Cramlington, Seghill, &c. For some years after these speculations were gone into, steam-coal was considered of little or no value; so that the main object of these collieries having been defeated, in the moment of *despair* and on the point of abandonment, the unlooked for demand arose for this sort of coal from every part of the world, for steam-boat purposes, and caused these collieries to rise into extraordinary fame; so much so, indeed, that the aggregate vend of Cramlington colliery, in the year 1841, was 60,000 chaldrons. This success has led to the speculations of West Cramlington, Seaton Delaval, Sleekburn, &c., as well as extensive openings upon similar coal all over the district; so that its market is also greatly overdone.

Since the year 1810, inclined planes and public railways have become so generally adopted, as facilitating the conveyance of coal, that many of the distant collieries have again been brought into operation, viz., Stanley, the country to the westward of Chester Burn, Marley Hill, Andrew's House, Greencroft, the new district to the westward on the river Wear above Brancepeth, Shincliffe and the parts east of Durham, Medomsley, Pontopike, &c., thereby putting into the market an overpowering supply of the soft secondary coal, which, although well adapted to the making of coke or gas, is ill fitted for steam or house purposes, and is therefore at present at a great discount.

The number of collieries now in work in this great trade is as follows:—

In the department of the Tyne - -	70
Wear, including Seaham - -	28
Hartley and Blyth - - -	6
Stockton - - - - - -	22
Total -	126

The highest selling price, on board ship at Sunderland or Hartlepool, is 30s. 6d. per Newcastle chaldron of 53 cwt.; and the lowest skreened round coals on the Tyne, 12s.

Efforts have been made, from time to time, to found, under an act of parliament, a general provision for decayed colliers, or for the families of men whose lives have been lost in the various accidents occurring in coal-mining— the funds to be contributed partly by the coal-owners, and lessors of royalties, way-leaves, &c., and partly by the colliers themselves, on a per centage of their earnings; but these propositions have been uniformly objected to by the workmen, chiefly from the impression that it was with a view of relieving the parishes and to benefit the owners. Were such a project ever to be carried into effect, it would constitute one of the most splendid institutions that the country could boast of, and would be well worthy the talent and philanthropy of the benevolent Lord Ashley, whose labours in parliament, in defence of the juvenile and female labourers of the mines, cannot but entitle him to the thanks of the public.

SECTION III.

RISE AND PROGRESS OF COLLIERY ENGINEERING SINCE THE YEAR 1700; INTRODUCTION OF THE STEAM-ENGINE, AND ITS CONSEQUENCES.*

As it is justly remarked that necessity is the mother of invention, so does it necessarily follow that colliery engineering may be said to have arrived at a state of greater perfection in this district than in any other part of the world. In the first place, the quantities raised have exceeded those of all other parts; and the depth of the pits, the quantity of water, and, above all, the great and general discharges of inflammable air, have necessarily demanded the most effective and practical science. It is, therefore, under this section that I propose to enumerate the progressive improvements that have been made, applicable to the sinking, working, and carrying away the produce of these coal mines. The subject is interesting, inasmuch as it brings under our familiar observation some remarkable events and discoveries, which not only operate upon the especial subject of this essay, but also upon the general trade of the country, and of this district in particular.

First Era.—At the Close of the 17th and the Commencement of the 18th Century.

The only districts in the north of England, from whence coal was shipped at this period, were the rivers Tyne, Wear, and Blyth.

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* The principal portion of this section was read by me at a meeting of the Literary, Scientific, and Mechanical Institution of Newcastle.

Notwithstanding the great distances from which the coals in those days were brought, the waggon-ways were all of wood, and even the wheels of the waggons were of the same material. The waggon-ways were constructed of a double tier of rails (the top one always of oak or beech, as best constituted to stand the alternations of wet and dry), and laid upon wooden sleepers, to which they were pinned with wood. These waggon-ways were most rudely constructed, being laid nearly according to the undulations of the surface; for the idea of inclined planes had not at this period entered into the notions of mankind.

In 1745, the cost of a yard of wooden way was 4s. 2d., viz.: —Two yards of oak rails, 1s. 2d.; three sleepers, 2s. 6d.; pins, 1d.; laying, 3d.; filling and ballasting, 2d.

The cost of a 20-boll waggon in 1723 (then a good deal used) was £7, 1s. 2d.

The waggons were regulated in their speed by convoys, bearing upon a single wheel; and in order to prevent the wear of the wheels (which were extremely expensive to maintain), they were studded thick with nails driven up to the heads; but the wear was proportionably great upon the breasts of the convoys, which was a source of great labour and expense. The braking of the waggons down the many rude steeps, was attended with continual loss of life, both to man and horse.

Cast-iron rails for waggon-ways were introduced in 1767, at Colebrook Dale. In 1776, Mr. Curr invented his underground tramways of cast iron.

The coals were drawn from the mines by horse machines, called "gins;" the earliest known construction (though perhaps it was an improvement on one still earlier) being called a "cog and rung gin," the horse-wheel being vertical and toothed. In fact, a spur wheel and pinion turned an horizontal shaft lying over the pit, to which the ropes were attached. This machine was then but of recent introduction, the pits of minor depth being wrought by hand windlasses or jack-rolls.

In 1746, the price of drawing by gins, with a 16-peck corf, for 30 fathoms, was 10d. per $4\frac{3}{4}$ tons, and 1d. for every 5 fathoms of additional depth.

The "whim gin" was an improvement upon the complex combination of the cog and rung, and has universally superseded it.

The drainage of the mines, at the period now under consideration, mainly depended upon day-levels or adits. Sometimes it was effected by means of horses and chain-pumps; and in certain situations, where advantage could be taken of a running stream, or of water from a higher altitude, a water-wheel was employed. Parts of Heaton and Jesmond, for instance, were won by means of a water-wheel wrought by the stream of the adjoining burn. In 1676, Lumley colliery had chain pumps wrought by water-wheels. Mr. Bald writes that, in 1690, water-wheels and chains of buckets were commonly employed to drain collieries in Scotland. The axle of the wheel (he says) extended across the pit mouth, and small wheels were fixed upon the axle, to receive endless chains of two or three tiers, which reached down to the coal. To these chains were attached a number of oblong wooden buckets or troughs, in a horizontal position, which circulated continually with the chains - ascending on one side and descending on the other, alternately full and empty—discharging as they turned over the wheels on the great axletree. A smaller machine of the sort was occasionally worked by horses, "as well as by windmills." Some of the latter were in use in 1708.

The steam-engine for draining mines was introduced early in the last century. The first was erected at Oxclose; the second at Norwood, near Ravensworth; and the third at Byker, in 1714. In 1720, it had come into general use. It was invented, or introduced, by the son of a Swedish nobleman, who taught mathematics in Newcastle. The art of self-government was not then discovered. The engine was wrought by the alternate opening and shutting of cocks by an attendant. But about four years afterwards (viz. in 1718), a person named Beighton invented the means of producing the desired effect from the machine itself.

These engines were on Newcomen's principle,* viz., an open-topped cylinder, the vacuum being created underneath the piston by injecting cold water into the cylinder, and realizing an effective pressure of from 4 to 5 ℔. per square inch on the piston.

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* Newcomen's patent was taken out in 1710; and the first engine was erected at Wolverhampton in 1715.

Mr. W. Brown, of Throckley, an eminent viewer of that day, was remarkably conspicuous in the introduction of the steam-engine to this colliery district. In 1756, upon getting the management of Throckley colliery, he built one there—then a great rarity. In 1757, one at Birtley North Side, one at Lambton, and one at Byker. In 1758, two at Walker, and one at Bell's Close. In 1759, one at Heworth. In 1760, two at Shire Moor, and one at Hartley. In 1762, one at Oxclose, one at Beamish, and one at Benwell (which had not only three boilers, but 24-inch wooden pumps, formed of staves). In 1763, one at West Auckland, with wooden pumps of 18 inches diameter. In 1764, one at North Biddick, one at Low Fell, and three in Scotland (viz., one at Borrostowness, one at Pittenweem in Fifeshire, and one near Musselburgh). In 1766, one at Lambton. In 1772, one at Fatfield. In 1775, two at Willington, and one at Washington (with its house contrived to take in a second). In 1776, one at Felling.

The present Allerdean engine, at Ravensworth, was built about the year 1750; up to which period scarcely any pumps exceeded 8 or 9 inches in diameter, and scarcely any engine had more than a single haystack boiler.

The coals, in the early period of mining, were invariably drawn in corves or baskets. The trams had broad wooden wheels. The tramways were constructed of three planks, the upper one forming an elevated ledge for the guidance of the tram.

Horses were as yet scarcely introduced under ground; but when they were, the roads were constructed in the same manner as those above ground, the rollies carrying two or three corves each.

Screens were not at this time invented. All the produce of the mines was sold, save what was consumed by the engines and the workmen. The first screen is said to have been introduced by Mr. W. Brown, at Willington colliery, about the year 1740.

The coal prices did not exceed 10s. per Newcastle chaldron; yet, from the lowness of wages and the cheapness of materials, collieries were productive of profit, and, after the introduction of the steam-engine, became objects of general attention. Hewers' wages were from 1s. 6d. to 1s. 10d. per day, and those of other workmen in proportion.

In 1744, Friar's Goose coals sold for 11s. per chaldron, and the cost of a chaldron waggon was £9.

In 1745, the hewing price of Lumley Main coal was 1d. per peck, or 1s. 9d. per 4¾ tons. The 12-peck corf was used, for the convenience of drawing with gins. The Byker Main coal, 20-peck corf, 1s. 6d. per 4¾ tons. Putting, 10d.

The art of ventilation was little known, especially the underground furnace; but the working of the coal was confined to seams at shallow depths, and in which inflammable air existed in only small degrees. Still, in consequence of the ignorance of ventilation, explosions were frequently happening, even in those days, and gradually called into existence air-tubes, ventilating furnaces, &c.

In 1732, fire-lamps, or furnaces, were first known at Fatfield colliery, where many and serious explosions took place, as will hereafter be enumerated.

In 1756, the first air-tube was built at North Biddick colliery, Mr. William Allison being then the viewer.

The cost of boring, in 1746, was 5s. per fathom for the first 5 fathoms, and 5s. per fathom extra every successive 5 fathoms. A three-inch hole cost £26 for 31 fathoms.

Blasting by gunpowder was then in its infancy, many pits and drifts having been executed simply by the hack and the wedge.

Whilst the steam-engine was imperfectly understood, the collieries in operation were necessarily those whose seams were lying at trifling depths from the surface, and not burthened with any considerable quantities of water; for the only pumps in use were bored from solid wood, and the diameter was consequently confined to 8 or 10 inches. The joints were spigot and faucet, and there was a difficulty in keeping them tight, when the pressure exceeded 25 fathoms. As no means were devised of stopping back shaft-water, the only relief that could be made available was by means of off-take drifts; the engine-pits being (where practicable) sunk convenient for such purposes.

The coal-keels or barges, on the Tyne and Wear, were nearly of the same construction as at present; but their rig, not only at the time first mentioned, but for many years afterwards, consisted of a lug sail; and the coals were carried in bulk in the hold—not piled up as at present, by means of timberings—the collier vessels being of much smaller burthen than at present, and their port-holes proportionably low.

Round ropes were universal in the north of England, chains never having found the favour which they have enjoyed throughout Scotland, Wales, and other coal districts.

Women were employed under ground, but not generally, nor in great numbers; but, about the pit-heaps and staiths, much of the labour was performed by them, both in cleaning the coals, and barrowing them from the depôts or staiths into the keels. Their standard price for such work was from 1d. to 1½d. per ton.

During this epoch, it being considered that where the coal lay beyond the depth of 60 fathoms it was next to inaccessible, there was great eagerness to monopolize those districts lying within the known powers of winning. "The Grand Allies," consisting of the Ravensworth, Strathmore, and Wortley families, under the advice of their far-seeing agents, leased many of the available tracts of coal; but improvements of the steam-engine, and the application of cast iron to the various purposes of mining, produced a new era, paving the way to the opening of those extensive and valuable collieries below Newcastle, in the Wallsend seam, and the deeper collieries upon the river Wear; whilst the monopolists were saddled with long and costly leases, of which they were not able to rid themselves for many years afterwards.

Notwithstanding the limited powers of production then known, so confined was the application of coal to the purposes of life, that the trade could always be overdone, and the sale constantly demanded a similar artificial restriction to that which now prevails ; for even early in the seventeenth century, when not more than a dozen collieries supplied the Newcastle trade, the owners were obliged to buy each other out of the market, or use other expedients for curtailing the over-supply.

The winters were then much longer and more severe than at present ; so that, for the period of six or eight weeks, about Christmas, every branch of the trade—pits, keels, and ships—all settled to rest ; the people at the respective markets being obliged to lay in beforehand suitable stocks of coal, whereupon to work during the winter months.

Previous to the year 1765, the art of ventilation had not progressed further than to produce a good current along the extremities of the working places, leaving the internal parts of the waste or old workings stagnant, and preparing a magazine from which serious explosions frequently occurred. This mode of airing continued to be practised in the collieries of the river Wear long after the coursing system was adopted upon the Tyne, being maintained at much less expense, and the additional charge thought unnecessary. Mr. Spedding has been said to be the inventor of the coursing system ; but according to a record in my possession, it was first put in practice at Walker colliery, by Valentine Carter and W. Morris, who had been sent for from the river Wear after an explosion. They ventilated all the wastes by coursing the air alternately up and down a pair of boards ; and the system was constantly pursued afterwards, in the Tyne collieries.

Second Era —Sixty Years ago, viz., about 1780.

Since the introduction of the steam-engine, a series of unlooked-for improvements have followed in every department of practical engineering, connected with the winning, working, and conveying to market the produce of the collieries.

Upon the river Tyne, the steam-engine had led to the opening of Walker, St. Anthony's, Bigge's Main, Willington, Killingworth, Wallsend, Hebburn, Heaton, Sheriff Hill, &c. ; and upon the Wear, the collieries of North Biddick, South

Biddick, Pensher, Rainton, Chartershaugh, New Washington, Urpeth, Leefield, Pelton Fell, &c.

Previous to this period, the steam-engine had become indirectly applicable to the drawing of coals from the mine, which enabled an extraordinary increase of quantity to be realized, and that, too, of a quality greatly superior to the produce of many of the old colliery districts. This not only rendered abortive all attempts to preserve the old monopoly, but produced such a superabundance of coals as to induce a much more systematic plan of coal regulations than had hitherto existed.

In the year 1787, a new regulation had been entered upon, and the prices of coals established as follows, viz.:—

	Tyne.		Wear.
Best - - -	20s.	-	18s.
Second - - -	18s.	-	15s.
Inferior - - -	15s.	-	14s.

The coal-owners suffering a deduction of 1s. 6d. per chaldron on the Tyne, and 2s. 6d. on the Wear.

In proportion as the competition increased, so had individual exertion increased, to enhance the value of the article, and to lessen the expense of production. Hence the introduction of wooden screens at the pit-heaps. The wooden waggon-ways and waggon-wheels were giving place to those of cast-iron, and the common waggon-convoy was yielding to the double brake.

Although, however, the coal might now be said to be drawn by steam, it was not by direct application, but by the intermediate agency of a water-wheel, supplied by water pumped up into a cistern by means of the common steam-engine before described. The double bucket-wheel had two sets of buckets for alternate motion, the rope-roll being placed upon the same axis. The celebrated Mr. Smeaton introduced the single bucket water-wheel, revolving always one way, the rope-roll being attached to a separate axis, and worked by means of teeth-wheels, the motion being reversed by levers; but the simplicity and easy management of the double bucket-wheel rendered it of universal adoption.

The direct application of the steam-engine to the drawing of coals was in this era attempted, and many failures were the result; for in the atmospheric engine, the beam-head, communicating with the piston rod by means of chains, was very indefinite, and the management of it exceedingly difficult. The ingenuity of Boulton and Watt mastered the difficulty by the invention of the double-powered or close-topped cylinder, with separate condenser, rendering the engine easy of management. This invention gave a new impetus to the raising of coal, and gradually superseded the water-wheels.

The first engine upon this construction, for pumping water, was erected at St. Anthony's, about 1790, and is said to have been a failure; at Walker it succeeded, in 1796. The sinking of Hebburn first pit was accomplished by Mr. King, Sen., in 1794, before the double-powered engine was introduced; but the B pit was fit up with a Boulton and Watt double engine, with V bob, under the management of Mr. King, Jun., in 1797, and was followed by a similar adoption at Jarrow in 1803; and at South Shields, in 1805, under Mr. King, who also introduced tho solid crib tubbing in the sinking of these two collieries. The great advantage of this application consisted in counterpoising and pumping part of the load from the cylinder end of the beam; whereas, in the common engine, all the load must be lifted from the outer-end. This was by means of a diagonal spear and V bob, connected with a lever fixed at a certain distance down the shaft. Cast-iron pumps were now obtained of 12, 14, 16 inches diameter; and, with the improvements before spoken of, and other comcomitants, brought into command 10 or 12 ℔. per inch steam-pressure, instead of 4 or 5 ℔., as formerly.

The stopping back of shaft-water, too, had been carried into effect by the application of plank tubbing, consisting of cribs placed at intervals, according to the intended pressure, to which were spiked planks made water-tight. Inside of this planking were ranged another set of cribs, to which were nailed strong deals, to enable the shaft to be applied to coal-drawing. So effective was this application, that it enabled otherwise insurmountable difficulties to be overcome. Hebburn, Jarrow, South Shields, &c., were won by this means, as aforesaid.

Crib-tubbing rapidly succeeded the plank-tubbing, which consisted of segments of solid wood placed upon each other, the joints being filled up with slit deal, and wedged. This was found to be a great improvement upon the former plan, getting rid altogether of nailings, which were peculiarly subject to corrosion. Many shafts were executed upon this plan; but the labour and expense of so much wedging were found still objectionable. Cast-iron, therefore, was resorted to, and was first tried at the King pit, Walker, by the late Mr. Barnes, in the year 1795. His tub consisted of cylinders, the whole diameter of the pit, placed upon each other, and the joints wedged in wood; but the application was found inconvenient, except immediately at the top of the shaft. One of the Hetton pits was sunk through the quicksand by means of these solid cylinders of cast-iron, of great weight.

The first practical improvement upon the cast-iron tub was in the sinking of Percy Main pit, in the year 1796, under the management of the late Mr. Buddle. It consisted of segments four feet by two, with inside flanches bolted together; the inconvenience of which very soon pointed out the now ordinary form, flanching outwards, and without any bolts at all. The first application of this species of tubbing (which has being universally adopted since), was in the sinking of Howdon pit, in 1805.*

This mode of carrying into effect the winning of collieries, has scarcely ever been practised in either Scotland or Ireland. I applied it, for the first time, in the sinking of Preston Grange colliery, East Lothian, in the year 1830, and for which I had the honour of receiving a medal from the Society of Arts. I applied the plank-tubbing, also, with success, in the sinking of one of the Castle Comer pits, County Kilkenny, Ireland, in the year 1830; and the cast-iron segments at Slevardhar colliery, county Tipperary, belonging to the Irish Mining Company, in 1840.

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* Experience now shews that these cast iron tubs are liable to great waste and corrosion in wet upcast shafts, the metal becoming perfectly carbonized, and losing almost entirely its natural strength; hence serious expenses have resulted in the replacing of these tubs in some of the deep hot shafts.

The facilities afforded in the winning of the deep collieries, by the introduction of the steam-engine antecedent to the year 1750, led to an extraordinary increase of adventure in the trade, accompanied by a corresponding advance of wages, at the same time that the price of coals also was gradually advancing.

In proportion as the deep collieries came into existence, so also increased the difficulties of ventilation, requiring greater science, and more efficient means of insuring steady and effective currents of air. This gradually led to the adoption of air-furnaces—first above-ground, by means of tubes communicating with the upcast shafts, and soon afterwards by having lamps or furnaces under-ground (the heating of the shafts being ascertained to be one of the most powerful auxiliaries)—the carrying of the air through the working places by means of brick stoppings (first introduced at Fatfield colliery, on the Wear, in 1754, in consequence of some heavy explosions)—the airing of the individual places, by means of wooden partitions or brattices—and subsequently the air-pump. But still, the idea of subdividing the air into different currents was not entertained; the consequence of which was, that frequently the whole current became so loaded and adulterated with inflammable gas, as to fire upon the rarefying furnace and the workmen's candles, even in the general air-course. As an instance of the practice prevailing at that time, and for many years afterwards, even in 1804-5 the air of Hebburn colliery was calculated to traverse not less than 30 miles, before it reached the surface at the upcast shaft. The keeping of these numerous air-courses, which must needs be continually travelled, was the source of immense expense, as well as of continual danger.

The fire-lamp was introduced in 1732, at Chartershaugh colliery, at the Scrog pit, by Edward Smith.

The temperature of coal-mines is now pretty well known to be in proportion to their depth. A single instance, from my minutes of January, 1820, will show the effect in different situations of Jarrow colliery :—

	Deg.
At the surface - - - - -	46
At the bottom of the pit, 146 fathoms -	61
Return air, after having travelled the workings	75
Engine-boiler house, 700 yards from the shaft	144

The maintenance of the deep collieries in ropes, many of them with hot furnaces blazing below, became matter of great importance, and led to vast improvements in round rope-making (for which various patents were taken out), having for their object to lighten the article, whilst the laying and spinning were improved.

The increased demand for coals had greatly advanced wages of every description. Machinery increased apace, great numbers of horses began to be employed underground, and every thing was tending to open out a great and flourishing trade. The employment of women below-ground had ceased, although about the pit-heaps and staiths many were still continued.

Blasting with gunpowder, too, had become well known for stone-work, but was not common in the working of coal. It began, however, to indicate a great saving of labour, and was fast being introduced.

The system of pillar and board may be said to be universally adopted in these districts. "Long wall," or taking all the coal away at once, is greatly disapproved of, as well as thought very inapplicable to the carrying off the inflammable gases and choke-damp.

The working away of these pillars in the fiery collieries was first practised at Chartershaugh, on the Wear, in 1738, Edward Smith being then viewer. For many years, in the collieries of Wallsend, Bigge's Main, Willington, &c., the utmost proportion of pillars attempted was one-half of every other wall, or a quarter of the remaining coal, which invariably brought about a creep; but, after the said creeps had become settled, and especially after the invention of the Davy-lamp, these crept workings were for the most part cut out, and subjected to another working of the remaining pillars as before explained.

The quantity of coal left in pillars, in the fiery collieries, forming upwards of two-thirds, and hitherto thought unworkable, from the fear of either fire or water, was gradually being wrought away, where upstanding; but in the deep colleries of the Tyne, such as Hebburn, Percy Main, &c., the working of pillars was thought impracticable, and they were therefore left as small as in the judgment of the managers would barely support the roof; and although this continued effective for many years, yet, in the gradual wasting of the mine, the letting in of water, or from other natural causes, these collieries were invariably overtaken by creeps, whereby the whole workings were virtually closed, and the said pillars to all appearance lost.

During the process of creep, the most tremendous discharges of inflammable gas took place; and if measures of safety were not devised, explosion was the natural consequence.

Third Era.—From 1780 *to the present Time.*

Immediately after the year 1780, a series of great and organic improvements succeeded each other, not only in the erection of the various steam-engines for pumping, but in every other department of colliery engineering; and as the use of coal, under the prosperous state of commerce, was rapidly increasing in all parts of the world, it caused the northern districts of England to flourish in a remarkable manner. The winnings of collieries, followed by the building of ships, and the extension of railways, caused an influx of that torrent of capital which has since so completely outrun all legitimate demand, and produced similar results here, to those produced by similar causes in the manufacturing districts.

Amongst the persons whose ingenuity tended greatly to the more effective prosecution of collieries, must be mentioned **John Curr**. Brought up in the neighbourhood of Greenside, he went in a subordinate capacity to the collieries of the Duke of Norfolk, at Sheffield; and, having an ingenious turn, he conceived the idea of cast-iron tram and rolleyways, with suitably improved single carriages for horses. As the deep pits were now beginning to be wrought to great distances, the invention was well received, and generally adopted, from the year 1776.

He also invented the flat-rope, which he manufactured himself; but the difficulty of stretching all the four strands alike, with the then machinery, was so great, that his patent yielded him little or no advantage; especially as the numerous improvements of the round rope were brought into powerful competition.

The improvements in the manufacture of cast-iron led to its application to screen bars, waggon-wheels, waggon-way rails, rolley and tram wheels, tubbing, &c., so as greatly to cheapen and facilitate all other movements.

As expedition was the order of the day, the build of the keels was modified, by which they were enabled to make five tides per week, instead of three, to the most distant collieries; and in due time the lug sail gave way to the jib and main sail —still further accelerating their speed.

In the year 1818, the application of steam-boats to the towing of vessels in and out of harbours, gave an extraordinary impulse to that part of the machinery of the trade; for by getting in and out of harbour in all ordinary weather, they were enabled to set at defiance those stoppages which formerly affected them, and this led to the abolition of the practice of lying up during the two winter months, both with them and the collieries. Hence the immense increase to the supply in these particulars.

In the same year, a dinner and piece of plate were presented to Joseph Price, Esq., of Gateshead, for his exertions in first applying the steam-boat to the towing of vessels.

Soon after the year 1790, the gas arising from pit-coal seems to have attracted attention, as capable of being turned to practical utility; for in 1798, Mr. Murdock employed it in lighting the Soho factory in Ayrshire.

In 1803–4, Mr. Winsor exhibited the effect of gas-light at the Lyceum theatre, London; and immediately afterwards it was brought into public use, in the lighting of factories, streets, &c., thereby laying the foundation for a great and unlooked-for consumption of the soft coals of the inferior collieries, both in this country and upon the Continent. The best coals for the purpose are those which yield the largest amount of bituminous product, and are the most free from dirt or sulphur. One pound of good coal will yield four cubic feet of gas. The coke remaining varies from 25 to 50 per cent. as compared with the original amount.

In 1838, Joyce and others took out patents for the manufacture of artificial fuel from charcoal, coal-dust, coal-oil, &c.

The introduction of inclined planes, both self-acting and by means of engine-power, led to another important branch of engineering. The first self-acting plane was effected by Mr. Barnes, at Benwell colliery, in 1797; the full waggons descending by their own gravity, and the empty ones being drawn back by means of a balance weight. The first attempt by engine power was made under the direction of Mr. Curr, about the year 1805, who applied an engine to raise the coals from the valley at Birtley to the high grounds of Black Fell, and which was immediately followed by the magnificent project of Harrison, Cook, and Co., in 1808, of conveying the coals from Urpeth colliery to the river Tyne, over the heights of Ayton Banks, by a succession of inclined planes, partly wrought by engines. The practicability was thereby fully established; but the cost so far exceeded all calculation, that the company was utterly ruined, and the concern shortly after changed hands.

The invention of the locomotive engine was the next great era; and as this department of mechanical science has led to such incalculable national results, and influenced in an especial manner the produce and consumption of coal, it certainly deserves particular notice in this little work, inasmuch as the honour of originating it has been the subject of much controversy.

The idea of locomotion was entertained by the celebrated Mr. Watt, about the year 1759; but he does not appear to have followed it out, either by a patent, or by constructing any engine.

In 1811, Mr. Blenkinsop, of Middleton near Leeds, aided by the advice and suggestions of the late Mr. John Straker, took out a patent for a locomotive engine, to be fitted up with toothed wheels, working into a corresponding rack rail, fixed along the centre of the railway, and which was afterwards adapted to one of the main rails. The friction and additional cost of this application were so great as to preclude any great hopes of its ever being made practically useful.

In 1812, Mr. W. Chapman took a patent for an improvement, by extending a chain along the centre of the railway, adapting the engine with certain grooved wheels, around which the chain was so led as to enable the engine to be pulled along, together with its load. This application was soon after tried at Heaton colliery, but was not looked upon with much confidence.

In 1813, Mr. Brunton, of the Butterly iron-works, fitted up an engine at Newbottle colliery, propelled by iron pillars, similar to the legs of horses; but this also was found to be inconvenient and objectionable, and was consequently abandoned.

Hitherto, as will be seen by the above detail, the only feasible scheme of obtaining effectual locomotion seemed to be the procuring of some fulcrum, as it were, upon which to operate with steam, or to propel by rack work, pulling, or thrusting. To operate by mere friction or gravity had not as yet occurred to any one, until the late William Hedley, Esq., viewer, who had the direction of Wylam colliery, conceived the idea; and having satisfied himself by a variety of experiments with the waggon-way carriages, he took out a patent for the invention, which bears date March 13, 1813. The experiments were made by men placed upon the carriages, and working the teeth gear by means of handles. The weight of the carriage, and the number of waggons drawn after it, were varied, but came to corresponding results, which were decisive of the fact, "*that the friction of the wheels of an engine carriage upon the rails was sufficient to enable it to draw a train of loaded waggons.*"

So conclusive were the experiments, that an engine was immediately constructed. "The boiler was of cast iron, with a longitudinal tube into the chimney--the engine had one cylinder and a fly wheel;" and although it was defective, it confirmed the principle. "A second engine was constructed with two cylinders, the boiler of malleable iron; the fire tube was enlarged, with a return tube to the chimney, now situate at the same end of the boiler as the fire-place; it was placed upon four wheels." This engine succeeded so well that it drew eight loaded waggons at the rate of four or five miles per hour, and completely superseded the use of horses, which at that time was a ruinous expense to the colliery, and notwithstanding that the railway was upon the tram-road system. *In justice, therefore, to Mr. Hedley, he is entitled to the honour of being the inventor of the present principle of locomotion.*

In 1814, Mr. George Stephenson, having given his attention to the subject, fitted up an engine at Killingworth colliery, the action of which was communicated to the wheels of the engine carriage by means of an endless chain, instead of tooth wheels, as in Mr. Hedley's; but, like that gentleman's, its action was solely by its own gravity, or the friction of the wheels upon the rails.

Up to this period, the great consideration was lightness; but it was soon discovered that the heavier the engine, the more effective it was; and these fundamental principles being now universally admitted, improvement rapidly followed improvement. But beyond the above general statements it is not my province to wander, further than to observe that the discovery seemed to hold out a new panacea for the distant coal-fields, and soon after led to the project of converting the Auckland district to the purposes of export, by means of the Stockton and Darlington Railway. This caused a new and most influential coal-field to be brought into competition with those of the rivers Tyne and Wear, at a time, too, when a great proportion of the prime coal of the former had been wrought away.

This railway, 25 miles from Stockton to Witton Park colliery, was opened in September, 1825; and so rapidly did its trade in coals increase, that in the year 1841 (16 years) a vend was realized of 498,000 tons.

The fulfilment of the sanguine expectations of the projectors of this railway, successively led to the adoption of those of the Clarence, Brandling Junction, Sunderland and Durham, Hartlepool, and Stanhope and Tyne; and consecutively to the enactment of the new harbour of Seaham, and re-organization of those of Hartlepool and of Middlesbrough, mainly depending upon the shipment of coal.

Those measures induced districts to be opened, and collieries to be founded, in quarters never before thought of for exportation. Each new speculation seemed to possess some advantage more prominent than those of the old collieries. Accumulative circumstances conspired to produce a superabundance of coal, from distant parts of the county of Durham, and to throw into the back-ground many of the collieries producing inferior coal upon the river Tyne.

About the year 1818, whilst competition ran high, a device was fallen upon by Mr. Croudace, then agent to the Lambton family, having for its object the twofold purpose of economizing the expense of casting the coals into the ship, and also of enhancing their value by avoiding breakage. This was by fitting up each keel with eight square tubs, containing a Newcastle chaldron of 53 cwt. each; which tubs were filled by lowering down the coal-waggon to the keel; after which, they were lifted up by a steam-engine, and delivered into the hatchway of the vessel, at Sunderland. The advantages of this system were so apparent, that a general adoption of it took place upon the river Wear; and all coals shipped in that manner held a superiority of price over those dealt with in the ordinary way.

The extensive use of the locomotive engine gave rise to another source of trade for gas coals, viz., the formation of coke; which is rendered more profitable, because it is manufactured from the screened small coal, otherwise unsaleable. To supply this trade, coking ovens have been erected in great numbers—not only in this district, but at the ports of delivery—whereby the broken coal is greatly absorbed. Notwithstanding, however, the various qualities of coal throughout the midland districts, many of them excellent of their kind, none are found capable of competing with those in the neighbourhood of Garesfield, Tanfield, Blaydon, and the Auckland collieries; which, in consequence, mainly supply the engines of the metropolitan and continental railways.

On analysis, the Garesfield and other coals have yielded constituents as under:—

	Redesdale, Up N. Tyne.	Wylam.	Garesfield.	Cannel, Lancash.
Carbon	45·95	48·49	72·71	56.4
Ashes	3·05	13·91	1·39	2·5
Volatile matter	51·	37·60	25·90	41·
	100	100	100	100

In order to obviate the breakage of coals upon the river Tyne, occasioned by the fall from the ordinary spouts to the vessel's hatchway, Mr. W. Chapman, about the year 1800, took out a patent for the drop, now so universally used, by means of which the waggon is lowered down close upon the hatchway of the vessel. Manifest as this improvement appeared, it was allowed to sleep entirely unnoticed, until within a short period of the expiration of the patent, when it was applied in 1810 by Mr. Benjamin Thompson, at Wallsend, and was afterwards generally adopted. In 1804, Mr. T. King also constructed a moveable railway at Jarrow colliery, suspended by blocks and chains, in order to accommodate the fall of the coals to the state of the tide.

The principles of ventilation had, since the year 1800, received very considerable light, especially in subdividing the principal column into subsidiary columns, with a view of keeping the working parts always supplied with air, which had not passed through any of the old wastes, and also in carrying such adulterated air through passages to which none but proper persons could get access; and instead, as heretofore, of passing the said adulterated air over the fire of the furnace, it was conveyed to the upcast shaft, without such intervention, the furnace being fed with fresh air. To carry out this system, artificial crossings have been introduced, by which one column of air is made to pass over another. The rarefaction has also been successively effected by introducing hot steam into the upcast shaft, and by heating the exterior of cylinders, through which the adulterated air was made to pass. Air-pumps wrought by steam-engines have also been in turn adopted. But all these devices have fallen to the ground, and left the simple rarefying furnace, properly guarded, as the most efficacious application to the production of a well-ventilated colliery.

The least quantum of air required in a fiery colliery (that is, in the principal passages) is considered to be from 350 to 400 cubic feet per second, or the area of the passage multiplied by its velocity; and in many well-ventilated collieries, the current amounts to 30,000 cubic feet per minute. The Belgian engineers consider 200 cubic feet per second requisite, although many of the mines do not possess above 80 to 100.

A column of air, 6 feet square, = 36 feet area, running at the rate of 3 feet per second, viz., 36 × 3 = 108 × 60 = 6,480 cubic feet per minute, was thought ample in former times, even in fiery collieries around Hebburn—say from 5,000 to 6,000 cubic feet per minute.

The project of obtaining part of the vast quantities of coal buried in the crept workings of most of the collieries in the High Main Seam, below bridge, led to most important events. In Walker, Bigge's Main, Wallsend, Heaton, &c., a partial working of those pillars had been made, previous to the creeps. In the more recent collieries of Hebburn, Jarrow, Percy Main, &c., the creeps had taken place before any such robbing had occurred.

The steel-mill, previous to the year 1815, was the only safeguard to such cuttings out; and although experience proved that after a certain period the inflammable air was greatly driven out, and was succeeded by carbonic acid gas, yet, from the crushed state of the mine, the expense would never have been borne, nor safety acquired, without some other aid: this desideratum was providentially acquired by the invention of the safety-lamp.

In 1813 was established, the Sunderland Committee for Prevention of Accidents in Coal Mines, Sir R. Milbanke, president, to whom was exhibited, by Dr. Clanny, his newly-invented safety-lamp, consisting of an insulated light, supplied with air by means of a pair of bellows; and to Dr. Clanny, beyond all doubt, belongs the honour of first conceiving the idea, and of executing a lamp to burn safely in an explosive atmosphere; in further corroboration whereof, I beg to add the following certificates :—

In May 1813, a paper was read before the Royal Society, entitled, " On a steady light in coal-mines, by W. Reid Clanny, M. D.," and which was soon afterwards published in the Philosophical Transactions.

On the 1st of October, 1813, the same safety-lamp was exhibited at the Literary and Philosophical Society of Newcastle-upon-Tyne, and to the members of the Sunderland Society above mentioned.

" An experiment took place this day on Dr. Clanny's lamp for preventing explosions in coal-mines. It was effected at the mouth of the upcast shaft of the Herrington Mill pit, by means of inflammable air obtained from a cast-iron tube, communicating with the Hutton seam, and witnessed by the undersigned.

" In order to ascertain the quality of the gas given out at this tube, a bladder was filled from it; and, on trial, its contents proved to be carburetted hydrogen gas of the purest nature.

" One end of the leaden pipe was affixed to the iron tube—the other end placed within a room which was quite closed up, except at the door where the pipe entered. In a very short time, the carburetted hydrogen gas became mixed with the atmospheric air of the room, up to the firing point; when the lamp, with a lighted candle within it, was carried to the centre of the room; and after conveying two or three draughts of air through the bellows, an explosion took place, which extinguished the candle without communicating to the surrounding inflammable atmosphere.

" The experiment was practised a second time, and the same results followed.

" On witnessing the experiment, the undermentioned William Patterson and Joseph Gleghorn declared that they would go into any part of a mine without fear, if lighted by this lamp.

"J. H. H. Holmes.
"William Patterson.
"Joseph Gleghorn.
"Anthony Hopper.
"George Patterson.

"Herrington Mills pit, Oct. 16, 1815."

The fourth certificate is dated Nov. 20, 1815, and states that Dr. Clanny, and Holmes, Patterson, and Birkbeck, descended the same pit, 101 fathoms, and made further experiments with the lamp, at a place in the mine where the gas was exuding from the "deads" of the Hutton seam below, and in an atmosphere where, "if the candle had communicated with the circumambient air, the mine would have been blown to pieces."

The following is a description of Dr. Clanny's improved safety-lamp, lately published by him:—

"In this lamp there is no inside apparatus as in Mueseler's lamp, and the wire-gauze cylinder contains no less than 512 more apertures to the square inch than in any other lamp heretofore known to the public. The lower part of the lamp is constructed with glass, half an inch thick, guarded by a brass shield; and the air with which the lamp is fed *descends* through the wire-gauze cylinder to the flame of the oil lamp."

The weight of Dr. Clanny's improved safety-lamp is 2 ℔. 2 oz.

In the year 1815, however, the safety-lamp of Sir H. Davy was discovered; and which led to the immediate and extensive re-opening and working of the crept wastes of all these extensive collieries, and has been the means of recovering millions of value in coal, otherwise irrecoverably lost.

It was on the 1st of January, 1816, that the lamp was first tried by me at Hebburn colliery. Simultaneous with this invention, was also the lamp of Mr. George Stephenson; but whatever might be the merits of the latter in point of principle, the practical utility of Sir H. Davy's has carried it into universal adoption.

To guard against the many bad consequences and loss of coal by creeps, and finding, moreover, the practicability of working away the pillars, even in the very deepest collieries, Mr. Buddle took up the suggestion of subdividing the coal-field into minor districts, defended from each other by thick barriers of coal, and ventilated by distinct currents of air; so that in the event of a creep happening in one district, it was utterly prevented from spreading beyond its decreed boundary. The advantages derived from this system were the procuration of nearly all the coal, uninjured by crush or creep, and a great saving of expense, by curtailing the quantity of waste, or dead mine, otherwise requisite to be aired and travelled.

Under-ground steam-engines have, since 1800, become frequently applied to the raising of coals and water from the deep workings—sometimes placed near to the shaft, but sometimes many hundred yards in the interior. The principal difficulty attending their adoption, consists in supplying them with fresh air, without incommoding the other parts of the mine, and also of safely providing for the conveyance to the upcast pit of the hot smoke—the want of which has, in very many instances, produced the firing of the coal, and the most grievous consequences thereupon.

So far back as 1776, an under-ground engine was placed 80 fathoms down Saltom pit, at Whitehaven colliery, for the purpose of pumping water from the low level to the great seam.

Various improvements had taken place in the under-ground *hand*-pumps. The rag or chain pump had nearly disappeared, and was superseded either by common bucket-pumps, lifting one to another by means of wooden boxes, or the single forcing pump, wrought by lever, and fitted up with pipes. As an improvement upon this, in 1812, I introduced at Hebburn a double forcing pump, with fly-wheel attached.

Triple cranks, worked by horses, were also in common use at this period, for forcing water from the deep workings.

The water in the deep collieries of the Tyne and Wear is uniformly salt, accompanied with various other admixtures. The water at St. Lawrence, near Newcastle, has been analyzed as follows:—

Sulphate of lime - -	44·88
Chlorite of calcium - -	854·08
Chlorite of magnesia - -	193·92
Sulphate of iron - -	7·28
Common salt - - -	2938·24
	4038·40

About the year 1812, the late Mr. Crowther, engineer, conceived the idea of substituting the corves or wicker baskets with sheet iron tubs of similar form. They were set to work at Washington colliery; but as they had to pass each other at speed in the shaft, they were found impracticable and discontinued.

In the year 1836, a substitute was attempted for corves, at South Hetton colliery, by applying a large iron tub, holding upwards of a ton of coals, and emptied by machinery. It was adopted at two or three other collieries; but it very soon gave way to square tubs, fitted up with wheels, and containing from 6 to 8 cwt. each, drawn up the shafts in cages moving in conductors. They are sometimes made of iron, but more commonly of wood; and are found to be so decided an improvement upon baskets, that they have since come into general use. It is somewhat strange that this system of drawing coals was also invented by Mr. Curr, and has been practised ever since, in the Yorkshire and Derbyshire collieries, but was never until lately adopted by us, although possessing such decided superiority in many other respects.

About this period, the patent safety fuze was invented by Messrs. Beckford and Co., of Cornwall, consisting of a hempen tube, an eighth of an inch in diameter, containing a core of gunpowder, about the size of a small needle. The fuze is placed in the charge—tamped up—and fired off with safety by lighting up the end. It burns at the rate of about 30 inches per minute, and contributes vastly to both safety and economy, being sold for about 8d. per 24 feet. It is getting into general use.

The wire rope invention came into notice about the year 1836; and round and flat ropes of iron are now in current use, both in shafts and upon inclined planes, for which latter they are especially adapted.

At the Cork meeting of the British Association in 1843, Mr. Bowness, of Workington, transmitted to Professor Sedgwick a plan for raising coals without either ropes or chains, as follows:

First, the shaft is fitted up with four spears as guides.

Second, the main working spear is attached to a crank of the engine, making a 12-feet stroke in the pit.

Third, these fixed spears are furnished with pauls or catches at every 12 feet, whereby to sustain the full tub whilst the stroke is reversing.

Fourth, upon the working spear are attached bars of iron at every 12 feet, so contrived as to take hold of the bow of the tub, and lift it up a stage, to where it is held by the catch, till the returning stroke; and so on till the tubs successively reach the surface.

The preservation of the mining property, and of the lives of the people, has not only engaged the attention of the most talented of the colliery managers, but also of committees of gentlemen not immediately interested in the trade. Such was the committee of 1813, founded by Dr. Grey (then rector of Bishopwearmouth, late bishop of Bristol), having for its president the late Sir Ralph Milbanke, Bart. The efforts of this committee, and the reports and papers published by them, were the means of drawing Sir H. Davy's attention to the subject, and led to his invaluable discovery of the safety lamp in 1815, as before related.

SECTION IV.

ANALYSIS OF DR. M'NAB'S VIEW OF THE COAL TRADE IN THE YEAR 1792, HIS LETTERS IN 1800 AND 1801, AND MR. EDINGTON'S WORK IN 1813.

STATEMENT of the number of persons employed above and below ground on the rivers Tyne and Wear, viz:—

	Tyne.	Wear.
At collieries, waggons, keels, fitters, trimmers, pilots, agents, &c., - - - -	9,854	7,080
500,000 chaldrons of coals will require 150,000 tons of shipping, requiring - - -	8,000	5,100
Carpenters, ropers, smiths, and other persons whose employment rises out of the trade	4,046	2,820
Other members of the families unemployed, but depending for support upon the workers	16,575	11,250
	38,475	26,250
Total - - 64,725		

The Wear calculation is made upon a yearly vend of 340,000 chaldrons, requiring 106,200 tons of shipping.

The Whitehaven district, and the Frith of Forth, were taken to employ also a population, including seamen, of 6000 persons. The Doctor says, "The custom which has lately taken place of screening the coals at the several pits, has been found to be very injurious; and that the constantly glutted state of the markets during the open trade, had led to the necessity of the coal-owners combining." The coal duties, too, were greviously oppressive, being ⅌ Newcastle chaldron:—

	s.	d.
To London - - -	16	6¾
Coasting duty - -	9	6
Foreign duty - -	15	5
Ireland - - - -	2	1

M'Nab's estimate of the duration of the coal-field is founded upon the following data:—

Total extent, 20 miles by 15 = 300 square miles.

Average thickness of seams, 4½ feet, out of which one-sixth to be left in pillars.

The Newcastle chaldron in weight 53 cwt., and the London chaldron 27 cwt.

	London Chald.
The estimated annual consumption to be, London	900,000
Coastwise - - - -	700,000
Foreign consumption - -	250,000
Local consumption - - -	450,000
Equal 3,100,000 tons.	2,300,000

He thus calculates, after allowing one-sixth; and taking a cubic yard to weigh a ton, that each square mile will contain 3,845,000 tons, and that each square mile will hold the consumption for one year and quarter = 375 years.

He also calculates the coal district between the west part of the above and Whitehaven to contain coal sufficient to serve the same consumption for at least 600 years; and as the exportation to Ireland was likely to be supplanted by the discovery of coal in that country, the increased duration of the western district, on that account, might be taken at 300 years, making in all 1200 years.

He states the capital employed in the trade as follows:—

Capital employed in the collieries and craft -	£1,030,000
Shipping in the two ports - - - -	1,400,000
Capital employed by the London merchants -	700,000
Total -	3,130,000

In 1800, Dr. M'Nab wrote to Mr. Whitmore, M. P., to the following effect:—

"The want of sufficient demand at market has always been the cause of embarrassment to the trade."

	ꝑ Lond. Chald.		Coastwise.	
	s.	d.	s.	d.
The duties at this time were -	8	10	5	6
Richmond shilling - - -	0	6		
	9	4		

And in the month of March, best coals were, at Newcastle, 26s. ℘ chaldron,—in London 50s. = £5.,—18s. 8d., of which went to government.

After 1773, the influx of collieries produced such an over-supply, that regulation was imperatively called for, notwithstanding the vend of certain collieries, in 1799, was as follows:

Hebburn	-	28,246	Heaton	-	30,082
Bewick and Craster		29,992	Wallsend	-	43,228
Willington	-	30,010			
					161,658

The increased value of materials, from 1791 to 1798, was as follows:—Deals, £7, 10s. to £10, 10s. per ton. Timber, 10d. to 1s. 4d. per foot. Powder, £4, 10s. to £10 per half-barrel. Ropes, 32s. to 52s. per cwt. Coals, 50s. to 70s. per wey. Candles, 7s. to 8s. 3d. per dozen ℔. Leather, 1s. 5d. to 2s. per ℔. Boiler plate, 30s. to 38s. per cwt. Iron, 18s. to 24s. per cwt. Labour, 30s. to 42s. per month. Do., 45s. to 63s.

In 1801, Dr. M'Nab, writing to W. Manning, Esq., M. P., chairman of the Coal Trade Committee, says that Wallsend produced, previous to the last agreement for regulation, in 1796, 49,795 Newcastle chaldrons; and in 1799, 43,328. Whilst it stood upon the basis at 64,500, other large collieries had only 45,000; the trade being willing to give that preference rather than continue the confusion that had reigned from 1782 to 1789.

Mr. Edington wrote upon the subject of the coal trade and its abuses in 1813. He states the price of coals on board ship at that time as follows, per Newcastle chaldron:—

Tyne,	1st class, Wallsend, &c.	4 collieries	34s. 6d.
	2nd do., Temple Main, &c.	6 do.	33s. 6d.
	3rd do., - -	6 do.	27s. 6d. to 31s. 6d.
	4th do., - -	3 do.	26s.
	5th do., - -	9 do.	25s.
	6th do., - -	4 do.	24s. 6d.
	7th do., - -	6 do.	22s.

The 5 Sunderland best coals were 30s. 6d. and 28s. 6d.; and the 5 seconds, 25s. 6d. to 26s. There were also several

inferior collieries, with indefinite prices; the Sunderland coals selling upon a par with the 3rd class of the Tyne.

State of the Carrying Trade in 1813.

176 chaldrons of Wallsend coals, at 34s.				£299	4	0
112 spoutage, at 6d.				2	16	0
8 keel dues, at 13s. 4d.				5	6	8
Beer and bread money				1	10	8
Coasting duty				8	16	6
Lighterage				5	2	8
Corporation charges and sundries				3	18	0
Insurance, £326				5	3	0
				331	17	6
London charges	£24	15	7			
King's duty, 12s. 6d.	214	3	6			
Factor's commission, disct., scorage, &c.	13	15	7	252	14	9
				584	12	3
Made out, 343 London chaldrons, 21 chaldrons per score, also receiving 8d. per chaldron metage, 51s.				876	11	1
Profit				£291	18	10

The coal-buyers' profits at this time were 12s. 6d. per chaldron.

In the county of Cumberland there were, in 1813, not above 570 colliers, raising about 660 waggons per day, or 3960 per week; each waggon containing about a London chaldron, or 45 Winchester bushels.

Wages for hewing had advanced during the last 12 years from 2s. 3d. to 3s. 4d. per day.

At this period, viz., 1813, the following speculative opinion was formed as to the exhaustion of certain collieries:—

In 7 years, Felling, Walker, Benwell, Wallsend, and Heaton, annual vends 133,000 chaldrons. In 14 years, Percy Main and Burdon Moor, annual vends 85,000 chaldrons. In

21 years, Hebburn, Jarrow, Bell's Willington, Manor, Killingworth, Coxlodge, Ellison's, Russell's, and Peareth, annual vend 261,000 chaldrons. Total vend 479,000 chaldrons.

In October, 1809, during the time of the continental war, when a great proportion of the ships belonging to the coal trade were profitably employed in the transport service at 25s. per ton per month, coals become scarce in London, and a consequent rise took place, best coals being put up to 34s. per chaldron. The ship-owners resisted this advance; and the coal-owners thereupon hired ships, at the enormous rate of 27s. per London chaldron; notwithstanding which the profits of ship and coal owners ran as follows:—

The coal-owner.

	£.	s.	d.
Invoice price of coals per Newcastle chaldron on board ship - - - - - -	1	14	0
Duty and factorage in London, at 16s. per London chaldron - - - -	1	12	0
To freightage of two London chaldrons and expenses, at 27s. - - - - - -	2	14	0
	6	0	0
Selling one Newcastle chaldron in London, 68s. 6d. per London chaldron - - -	6	17	0
Surplus	£0	17	0

Therefore, by the coal-owner freighting his own coals, in lieu of 34s. per chaldron he got 51s.

The ship-owner's profit was stated as follows:—

	£.	s.	d.
To 100 Newcastle chaldrons of coals, at 34s.	170	0	0
Meter's office, trinity dues, market dues, &c.	3	14	6
Metage and orphans' duty - -	12	10	0
King's duty and bond - - -	135	2	0
Factor's commission, scorage, &c. -	16	7	6
Carried over	337	14	0

	£.	s.	d.
Brought over	337	14	0
Undertaker's bill delivering cargo	25	0	0
Duke of Richmond's shilling, ballast, &c.	15	0	0
Lightermen for dispatch	2	2	0
Wages and provisions	60	0	0
	439	16	0
Sale of 214 London chaldrons, at 68s. 6d.	732	19	0
Profit upon a voyage performed in about 24 days	£293	3	0

Extraordinary price of coals, in London, per London chaldron :—

		Newcastle.		Sunderland.	
		s.	d.	s.	d.
1808,	Sept.	52	6	47	6
	Oct.	55	0	43	6
1809,	March	58	0	46	0
	April	63	9	52	6
	May	53	9	45	6
	Dec.	74	0	73	0
1810,	Feb.	74	0	73	0
	March	70	0	70	0
1810,	April	68	0	67	0
	July	58	0	50	0
	Aug.	59	0	59	0
	Dec.	68	0	54	0
1811,	Feb.	70	0	60	0
	March	66	0	56	0
	May	56	0	53	0
	June	56	0	53	0

SECTION V.

PARLIAMENTARY ENQUIRY IN THE YEAR 1800.

In the year 1800, a parliamentary investigation was set on foot regarding the alleged high prices of coals, and the existence and effect of the coal regulation. Before the committee were examined Charles Brandling, Esq., Nathaniel Clayton, Esq., Thomas Ismay, Esq., John Martindale, Esq., and several others ; and, amongst the various subjects enquired into, the following information was elicited, viz. :—

That the first coal regulation agreement took place in the year 1771, fixing the selling price of coals on board ship at from 12s. to 15s. per Newcastle chaldron, deducting therefrom as fittage upon the Tyne 1s., and on the Wear 2s. 6d.

In 1771, Washington coals were sold on board ship at 13s. 6d.; deduct fittage, 2s. 6d.; net price, 11s. for the waggon of 20 bolls. With regard to the rate of compensation expected by persons adventuring in collieries, the manager of Washington colliery said their capital was £15,000, for which they expected an annual profit of 15 per cent.

In 1782, there was great confusion in the trade, previous to which the best coals had been sold on board ship at 22s.; deduct fittage, 1s. 6d.; net price, 20s. 6d.

In 1783, a further agreement took place in the trade, which, with partial interruptions, has continued ever since.

In 1790, the loss per screening at this period was stated to be 2s. per chaldron.

In 1796, the Wear basis was, under the regulation, 306,000 chaldrons.

In 1799, the Sunderland fittage advanced from 2s. 6d. to 3s. per chaldron. The price of the best coals on board ship was 24s. 6½d.; add trimming 4d., and custom-house charges 10¾d.; in all, 25s. 9¼d.

The wages of pitmen had increased 50 per cent. within 10 years.

The number of keels in the river Tyne in 1790 was 338, and there were in 1799 only 319; whereas the number of keels in the Wear had increased from 412 up to 520. The number of ships engaged in the coal trade to London from these ports was 597.

The vend of coals from the river Tyne in 1780 was 366,260, and in 1785, 449,997 chaldrons.

The river Wear vend of coals from 11 collieries, during 5 years, with a basis of 276,000 chaldrons, was, in 1790, 283,416; in 1791, 292,354; in 1792, 314,030; in 1793, 298,104; in 1794, 278,888; and in 1795, 288,721. During the four following years, with a basis of 288,721 chaldrons, it was, in 1796, 253,020; in 1797, 273,625; in 1798, 268,801; and in 1799, 287,738.

The following is a statement of the vend of coals, in Newcastle chaldrons, from the north of England in 9 years :—

	FOREIGN.			LONDON.			COASTWISE.		
	Newcastle.	Sunderland.	Hartley and Blyth.	Newcastle.	Sunderland.	Hartley and Blyth.	Newcastle.	Sunderland.	Hartley and Blyth.
1791	45,702	54,150	127	320,218	51,759	28,044	78,149	194,949	11,657
1792	42,993	53,313	234	358,707	42,572	29,000	97,399	214,317	9,400
1793	34,105	50,064	48	357,368	43,035	24,546	108,181	211,977	14,004
1794	40,461	38,885	128	303,366	59,475	26,197	84,094	184,464	11,455
1795	40,342	5,884	48	342,540	79,157	20,362	120,956	203,790	11,132
1796	42,778	6,293	542	329,753	53,406	20,300	109,034	196,839	9,423
1797	38,149	6,434	32	348,646	56,978	27,434	110,520	219,604	12,172
1798	44,722	5,112	166	296,866	63,716	23,661	97,503	210,416	14,172
1799	43,366	4,039	127	332,165	75,232	26,642	115,654	223,339	15,047
	372,618	224,175	1,452	2,995,629	525,330	226,186	921,480	1,859,695	108,462

Mr. Ismay said that rye was the chief bread of the pitmen, the market price of which was, then, 11s. ⅌ bushel, but was sold to them by the coal-owners at 5s. ⅌ bushel. He also gave evidence that, in one year, during a "fighting trade," Throckley colliery, in which he was a partner, lost, upon a vend of 11,000 chaldrons, nearly £3000.

The vend from the river Tyne from the year 1786 to the end of the year 1799, had only increased in the ratio of 5091 chaldrons ⅌ annum, being in the year 1786 - 428,685
And in 1799 - 494,869

In 13 years 66,184

The price paid for coals in London, from the year 1734 to the year 1799, according to the account of the Earl of Thanet, founded upon 100 chaldrons, was,—In 1734, £135 12s.; in 1743, £145 3s., showing an average price in 10 years of 30s. ⅌ chaldron. In 1769, £192 5s.; in 1779, £218 15s., showing an average price in 10 years of 35s. ⅌ chaldron.

	Chaldrons.
The river Wear vend of coals in 1772 was -	257,274
And in the year 1799 -	287,738
Increase in 27 years = 1128 per annum	30,464

Mr. Ismay gave evidence relative to the increased price of working coals between the year 1792 and 1800, in which he enumerated not only labour, but leading charges, materials, engines, and, in short, every description of expense, which he summed up to 9s. 10d. per Newcastle chaldron increased charge.

The late Mr. Clayton, Town Clerk, was examined as to the profits of the coal-owners, when he gave evidence to the following effect:—"I have possessed the means, and have had frequent opportunities of adventuring in speculations of that nature. I have ever declined doing so, upon the principle that the average profits resulting from those adventures were inadequate to the employment of so much capital as they required, and to the risk attending them,"

The committee wound up their report by recommending stringent measures to be taken to put down the combination, and also to encourage the inland coal; but no effectual legislation resulted from their labours.

SECTION VI.

PARLIAMENTARY ENQUIRY IN THE YEAR 1829.

In the month of May, 1829, a committee of the House of Lords sat, upon the subject of the coal trade; and amongst many other persons examined were R. W. Brandling, Esq., John Buddle, Esq., and Hugh Taylor, Esq., who successively deposed to the following matters:—

That the substitution of weight instead of measure would be highly desirable.

That the positive *waste* by screening, including coals stowed below ground, amounted to little short of one-fourth of the whole mine.

That the regulation broke up in December, 1828, and it was then an open trade. Complaints were made of the injustice of allowing the inland coals to be brought to London at less duty than those from the north, although that duty had been lessened in 1824 to the same rate as that on the coasting coals.

That there were, in 1828, 41 collieries under regulation on the Tyne, 36 of which vended 667,484 Newcastle chaldrons; and 18 on the Wear, 8 of which vended 441,337 chaldrons; making together 1,108,821 chaldrons.

Vends from the Rivers Tyne and Wear during 30 *Years, in Newcastle Chaldrons.*

	NEWCASTLE.		SUNDERLAND.	
	Coastwise.	Foreign.	Coastwise.	Foreign.
1800	537,793	47,487	298,837	4,622
1801	452,192	50,401	231,018	4,757
1802	494,498	44,000	305,075	31,205
1803	505,137	44,324	298,946	10,167
1804	579,929	52,589	299,552	4,162
1805	552,827	49,572	313,307	5,955
1806	588,277	46,683	306,271	2,613
1807	529,950	27,424	290,938	4,276
1808	619,125	16,001	348,623	2,058
1809	539,098	13,639	324,130	973
1810	632,299	17,253	370,712	1,919
1811	638,359	17,954	330,942	1,729
1812	630,633	24,985	338,854	3,148
1813	584,184	14,761	347,150	1,779
1814	649,151	31,986	373,241	11,029
1815	650,209	42,434	337,903	16,989
1816	678,151	43,783	387,687	15,930
1817	622,977	51,797	363,868	11,627
1818	671,871	47,744	391,780	15,839
1819	639,987	39,735	378,445	15,471
1820	756,513	44,826	415,972	14,425
1821	692,321	48,097	396,205	14,575
1822	655,159	54,160	396,921	16,418
1823	738,909	46,725	497,126	15,546
1824	687,603	49,044	491,187	15,880
1825	687,029	51,444	521,796	15,531
1826	792,365	62,620	545,656	14,498
1827	683,745	65,417	523,437	14,953
1828	725,082	59,325	509,567	22,941
1829	738,426	62,264		

Upon the subject of the price of coals, it was stated that the highest ever known under a regulation was 18s. to 18s. 3d. per London chaldron, = 36s. per Newcastle chaldron, and 2nd and 3rd class 4s. or 5s. per chaldron less.

Riddell's Wallsend was, in 1817, 30s. 9d.; 1819, 27s. 3d.; 1821, 30s. 1d.

Prices of coal per Newcastle chaldron, at different periods:

	1800	1805	1810	1815	1820	1825	1828
Russell's -	20s. to 27s.	30s.	34s.	34s.	34s.	33s.	33s.
Bewicke's Wlsd.	20s. to 26s.	29s.	34s.	34s.	34s.	33s.	34s.
Hebburn -	20s. to 26s.	29s.	33s.	34s.	33s.	30s.	30s.
Willington -	22s. to 26s.	29s.	33s.	33s.	33s.	30s.	30s.

In 1820, a return from 2s. to 3s. per chaldron was made upon the above prices.

Felling ranged as follows:—1803, 21s. 6d.; 1804, 23s. 1d.; 1805, 23s. 9d.; 1806, 21s. 6d.; 1807, 20s. 3d.; 1808, 19s. 2½d.; 1809, 23s. 9d.; 1810, 23s. 2½d.; 1811, 19s. 4¾d.; 1812, 17s. 9½d.; 1813, 19s. 5¼d.; 1814, 19s. 4d.; 1815, 18s. 11d.; 1816, 17s. 7¾d.; 1817, 17s. 9¾d.; 1818, 17s. 8¾d.; 1819, 17s. 7¾d.; 1820, 15s. 2d. The government duty was, at this time, 6s. 6d. per London chaldron upon the Tyne, and 6s. upon the Wear.

The highest price of Tyne coals was, in 1810, 17s. 3d. per London chaldron, = 34s. 6d. per Newcastle chaldron, which price continued till 1828.

Prices of coals at London before and after the taking off the duty of 3s. 4d. per chaldron, in 1824:—

		1822		1823		1824		1825		1826	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Bewicke's	Wlsd.	41	3½	46	0½	39	11½	39	7½	36	10¾
Russell's	do.	40	3½	47	1	39	10¼	38	10¾	35	4½
Stewart's	do.	43	6	48	0¼	41	6	40	5¼	38	1¾
Brown's	do.	37	11¾	42	11½	37	1¾	34	11	32	5¾

The coasting duty still remained 6s. per Newcastle chaldron.
Oversea duty, round - 17s. do.
Small - 4s. 6d. do.

The small-coal duty was reduced by the act of 1825, to encourage the vending of small coal rather than burn them.

Ratio of increased import into London from the years 1801 to 1828 inclusive, viz. :—

Population.		London chaldrons.
818,129	1801	859,738
872,125	1805	974,314
936,620	1810	1,720,237
1,029,379	1815	1,417,033
1,124,704	1820	1,313,736
1,220,791	1825	1,410,120
1,277,986	1828	1,540,875

The mean annual rate of increase during the first 14 years of the above period, is 21,293 chaldrons per annum, and for the latter 14 years it is 32,616 per annum.

				Rate of increase.
In 1801, the population of	London was		818,129	
1811,	do.	do.	953,276	1·65 ꝑ an.
1821,	do.	do.	1,144,531	2·33 do.

Averaging about 9 chaldrons for 8 persons previous to the general extension of gas works, and 10 chaldrons since.

The total import of coal during 28 years has been 32,580,515 chaldrons; and taking into account the number of population, gives 1·12 chaldrons per head per annum.

	Chaldrons.
Importation in 1780 - -	657,303
1790 - - -	742,937

The collieries at this period, 1828, were considered equal to produce twice the quantity of coals required.

In describing the dangers from explosion, it was stated, on the authority of Sir H. Davy, that the gas "would not explode, unless mixed with six times its volume of atmospheric air; and it would not explode when mixed with fourteen times its volume of atmospheric air." That one in eight was the most acutely explosive mixture. That to ventilate an ordinary mine, 18,000 cubic feet of air per minute were requisite, and that no provision was made for the families of persons killed in these explosions.

That the capital employed in the Tyne collieries exceeded 1½ millions of money independent of craft.

That the highest price of coals was during the war, and until 1828, when they were 17s. 3d. per London chaldron on board of ship.

That by no means 10 per cent. profit had been realized upon the general trade; and that it would require a continuation of the same prices to make an adequate return.

The then oversea duties were, upon round coal and nuts, 17s. per Newcastle chaldron, and upon coal passed through a 3-8 screen 4s. 6d. per chaldron; this state of things had been regulated in 1825, by what was called the small coal act.

The number of persons then employed in the trade, were stated to be	Tyne.	Wear.
above ground, - - -	3463	2300
Below ground -	8491	6700
	11954	9000
Say in round numbers, - - - -		21000
And accounting 220 London chaldrons to a vessel, and 1,400 vessels, there would be employed, men and boys, - - -		15000
Keelmen, boatmen, trimmers, &c. - -		2000
In and about London, and the coast, -		7500
Total, -		45500

The trade was free from regulation in 1821, and the greatest part of 1826.

The basis was for the	1824.	1826.	1827.	1828.
	Newcastle Chaldrons.			
Tyne, -	780,000	780,000	800,000	826,000
Wear, -	520,000	520,000	533,000	533,000
Total, -	1,300,000	1,300,000	1,333,000	1,359,000

	1824.	1826.	1827.	1828.
The actual vend coastwise was, Tyne, -	700,903	799,646	616,589	667,484
Wear, -	476,894	518,285	493,670	498,678
Total	1,177,797	1,317,931	1,110,259	1,166,162

According to a statement produced as made by a deputation from the Wear in 1816, it was calculated that 4,078,508 Newcastle chaldrons were supposed to be passing along the various canals in the midland counties to their respective places of consumption, and many of them trenching upon the parts formerly supplied by sea-coal, without paying any duty.

Mr. Brandling, speaking of the probable effects of a "fighting trade," says "that some of the larger collieries would feel it more severely than some of the smaller ones;" and on being questioned as to the permanency of the regulation, he said, "I know that some gentlemen were of opinion that the regulation would break of its own weight, that it has not been established on fair grounds.

The total consumption of coal in Great Britain was estimated on this occasion, as follows:—

	TONS.
England and Wales, (Manufactures) -	3,500,000
Households - - - - - -	5,500,000
All inland -	9,000,000
Coastwise, both sides of the Island, but exclusive of Scotland, - - -	3,000,000
Total -	12,000,000

The duration of this northern coal field was estimated by Mr. Hugh Taylor, as follows:—

From South Shields, county of Durham, southward to Castle Eden, 21 miles; thence, west to West Auckland, 31; north-east of Do. to Eltringham,

	Sq. Miles.
33; and thence to South Shields, 22 miles, being an area of - - - - - - - -	594
From Shields northward, 27 miles, with an average breadth of 9 miles, equal in area - - -	243
	837
Already excavated—Tyne, 39: Wear, 40: Northumberland, 26 = - - - - - - -	105
Total area -	732

	Tons.
And accounting 12 feet of workable thickness = 12,390,000 tons per square mile, x 732 = - - - - - -	9,069,480,000
Deduct one-third for waste and loss, in small coals, &c. - - - - -	3,023,160,000
	6,046,320,000

And taking the annual vend at 3,500,000 tons, it will give a duration of 1727 years; besides the south-eastern district yet unexplored.

Mr. Taylor's estimate of the consumption of the kingdom, is as follows:—

	Tons.
Annual vend of coals coastwise, from Durham and Northumberland - - - - -	3,300,000
" " Home consumption - - -	660,000
	3,960,000
Assumed consumption of 5 million of persons, and taking the whole population at 15 millions, this must be trebled, or - -	11,880,000
Iron works 600,000 tons of metal, requiring 4 tons of coal to a ton of metal, also extra consumption of Cornwall, &c. - - -	3,000,000
Export to Ireland - - - - - -	700,000
Total exclusive of exportation -	15,580,000

The principle on which these calculations were made was that

Cubic Inches.
282 = 1 Old Ale Gallon, and 277,274 an Imp. Gal.
1209 = 1 Peck.
9676·8 = 1 Boll.
77414·4 = 1 Fother.
23224.3 = 1 Newcastle chaldron, although 53 cwt. requires only 217,989 cubic inches Custom House measure, being a difference of 14·254 = 6·14 per cent., or 22·526, instead of 24.

One hundred years ago, the river Wear's vend was said to be only 65,000 chaldrons.

The importation into London, in 1801, was 836,917 London chaldrons, and has continued gradually to increase, till in 1828, it was 1,476,063 chaldrons.

	Basis.	Vend. Newcastle Chal.
The actual vend of the great Wear collieries in 1828, were of Lord Durham -	162,000	126,484
Marquis of Londonderry Do.	145,000	121,388
Hetton coal company - -	112,000	93,047

At this period, the actual vends amounted to 80 per cent. upon the basis; whereas, in the year 1843, the actual vends only amounted to 44 per cent., shewing a fearful consequence, arising from the disproportionate increase of collieries to the legitimate demand.

The committee does not appear to have made any report, as they were in hopes that the difficulties of re-enacting the coal regulation were so great, that legislation would be unnecessary.

SECTION VII.

PARLIAMENTARY ENQUIRY IN THE YEAR 1830.

In the year 1830, a third parliamentary investigation took place, by a committee of the House of Commons, at which were examined, from this part of the country, R. W. Brandling, Esq., John Buddle, Esq., John Clayton, Esq., and many of the coal-merchants and factors, as well as Dr. Buckland and Professor Sedgwick.

At this period, there were on the Tyne, at Blyth, &c., 42 collieries; on the Wear, 18; in all, 60.

The burning of small coals, the duties, the regulation, and the abuses in London, were the chief objects of enquiry.

Mr. Brandling, in answer to questions relative to the effect of the coal regulations upon the prices of coal, gave it as his opinion, that "*if the coasting and foreign duties were abolished, the demand for coals would so increase that regulation would not be wanted.*"

The relative weights and specific gravities of many coals were tried, and the difference found to be very trifling. The Wallsend coals were stated to be 78·945 ℔. per cubic foot; specific gravity, 1·263; weighing 28 cwt. 8 ℔. per London chaldron.

Russell's Hetton was 25·569 cwt. per chal., should be 26 cwt.

The then coasting duty was 6s. per London chaldron.

The London chaldron ought to contain 35·569 cubic feet. Breakage reckoned as 5 to 8; a cubic yard containing 5 bolls; but when broken to send to ships, it contains 8 bolls.

Rates of duties per Newcastle chaldron coastwise, as affecting this district:—To London, previous to April 5, 1824, 9s. 4d. round, 5s. small; from that time up to April 5, 1826, 6s. round, 1s. 3d. small; from thence to the present time, 6s. round, 6d. small. Other ports, previous to January 5, 1826, 6s. round, 1s. 3d. small; from thence to the present time, 6s. round, 6d. small. To Scotland, no duties on coals sent thither. To Ireland, during the whole period, 1s. 7¼d. per ton.

The foreign duties were, round coals 17s. per Newcastle chaldron, small 4s. 6d.

Abstract of charge upon Stewart Wallsend coal sent to London from the river Wear, 1830, per London chaldron:—Charges on the river Wear for 7 miles, loading and reloading. 4s. 9¾d.; government duty, 6s.; freight from Sunderland to London, 11s.; municipal dues, 4s. 9½d.; charges of delivery from the vessel into the cellar of the consumer, 13s. 7d.; original price paid to the coal-owner, 12s. 9d.; total, £2, 12s. 11d¼.

Shipments of coals oversea from the river Wear for the last 40 years, with duties payable thereon :—

Aggregate of 5 yrs. (Both inclusive.)	No. of chalds. of round coal.	No. of chalds. of small coal.	Duties on round coal, ⅌ Newcastle chaldron. £.	s.	d.
From 1790 to 1794	252,895	...	0	15	5
From 1795 to 1799	27,761	...	1	0	0
		...	1	1	0
		...	1	2	0
		...	1	2	1¼
From 1800 to 1804	54,903	...	1	2	3½
From 1805 to 1809	15,876	...	1	4	1½
From 1810 to 1814	21,225	...	1	5	2
From 1815 to 1819	43,496	31,255	1	2	1½
From 1820 to 1824	16,520	60,324	1	2	1½
From 1825 to 1829	17,588	76,268	0	17	1¼

The average prices of coals in the River Tyne, ⅌ London chaldron, were 1771, 6s. 9d.—1794, 9s. 6d.—1800, 11s.—1828, 14s. The selling prices in London were, for a series of years, as follows, including ingrain one in twenty-one :—

	£.	s.	d.			£.	s.	d.	
1788	1	10	4¾		1815	2	6	6	Hebburn.
1790	1	12	9½		1816	2	1	3	Hebburn.
1792	1	10	9		1817	2	2	0	Hebburn.
1793	1	15	0		1818	2	5	6	Bewicke W. E.
1795	2	1	10½		1819	2	1	6	Bell's W. E.
1797	1	15	2½		1820	1	17	0	Bell's W. E.
1799	2	2	0¾		1821	2	0	0	Bell's W. E.
1800	2	12	3½		1822	1	17	6	Bell's W. E.
1807	2	7	6	Adair's M.	1823	1	19	6	Brown's W. E.
1808	2	12	0	Bigge's M.	1824	1	15	6	Hebburn.*
1809	2	13	9	Hebburn.	1825	1	15	6	Brown's W. E.
1810	2	13	0	Hebburn.	1826	1	16	0	Bewicke W. E.
1811	2	11	9	Hebburn.	1827	1	18	0	Bewicke W. E.
1812	2	13	0	Hebburn.	1828	1	15	0	Brown's W. E.
1813	2	14	9	Heaton.	1829	1	11	6	Bewicke W. E.
1814	2	10	0	Hebburn.					

* Duty of 3s. 4d. per London chaldron taken off.

The reduction of the duty of 3s. 4d. per London chaldron in 1824, may account for the seeming decrease in London.

At this period lighterage, cartage, commission, credit, shootage, metage, &c., altogether amounted to no less a sum than 13s. 9d. per chaldron.

The average makings-out shewed that the Newcastle chaldron produced in the Pool 8 per cent. more than the double chaldron.

The committee ascertained that a London chaldron was 25½ cwt., that 4s. 8¼d. per ton was equal to 6s. the said London chaldron.

The average rates of freight were found by the committee to be as follows, per London chaldron:—1823, 13s. 11d.—1824, 14s. 1d.—1825, 13s. 11d.—1826, 13s. 8d.—1827, 11s. 4½d.—1828, 10s. 9¾d.—1829, 10s. 9¼d.

Charges of shipment on a cargo of 110 chaldrons of coals, at Newcastle:

	£.	s.	d.
Duke of Richmond's Shilling - -	5	10	0
Corporation dues - - - - -	0	18	4
Lights (Coast) - - - - -	3	13	7
	£10	1	11
Equal per London chaldron - -		0	11
Average keel dues - - - -		1	2¼
Trimming - - - - - -		0	2¼
		2	3½

The committee expressed their surprise, that whilst the average charge on board ship was only 14s., and the transhipment from port to port was defrayed by 6s. 3d., that the conveyance from the river Thames to the consumers should actually amount to 12s. 6d. per chaldron.

That with respect to the present price at which coals are sold, it is in evidence, that in 1828, when competition was increased by the discontinuance of the regulation, prices fell so low that many collieries suspended work; and in the opinion of some of the witnesses, the present prices were fully required to carry on the trade with any moderate profit.

The former duties had now been reduced, viz.:—The coals passed through a ⅜ inch screen were free from duty, but the round coals were still taxed with 6*s*. per chaldron.

The nuts were subject to the duty of 1*s*. per chaldron.

The government duty was, at this period, ascertained by vat measure; therefore, they benefited by the breakage of coals; for whilst 53 cwt. per chaldron was the weight of round coals, small coals would not weigh above 45 or 46 cwt.

Many of the abuses in London were particularized, such as the Bargemen's Company, &c.; and it was asserted, that if the trade was thrown open to free competition, from 6*s*. to 8s. per London chaldron might be saved to the consumers.

Mr. Buddle asserted, that 5 per cent. was the average profit of collieries after returning the capital. The highest rate of profit he knew of was, 14 per cent. including redemption of capital, viz., 5 per cent. profit, and 9 per cent. redemption.

The collieries on the Tees were not at this time included in the regulation, their best coals selling on board ship at Stockton, for 23s. per chaldron.

Touching the supply of coal from other quarters of the kingdom; during this investigation, a letter was read from the Rev. W. D. Coneybeare, upon the extent and quantity of coal in the South Welch Basin. He divided it into four districts, viz.:—1st. The Merthyr and Pontypool Basin, along a line of 35 miles, to the neighbourhood of Cardiff; throughout this range, the lower series of coals prevail. District 2nd.—Part of the lower series, the middle series being abundant, but not the upper. District 3rd.—The lower coals are workable all along the northern edge, but the southern is broken in upon by Swansea Bay. District 4th.—Pembrokeshire contains only the lower series, and it is, upon the whole, a broken district.

Mr. Coneybeare winds up his detail with the following summary; but it wants some of the figures to enable a stranger to compute the contents of this extensive coal field.*

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* In June, 1830, a paper was read at the Natural History Society, by Mr. Francis Forster, wherein he states the quantity of coal in the South Wales

	No. 1. Sq. Miles.	No. 2. Sq. Miles.	No. 3. Sq. Miles.	No. 4. Sq. Miles.
				100 by 17 feet.
Lower Beds....	105	300	120	525 by 35 feet.
Middle Beds ...	110	150	100	360
Upper Beds....	24		40	64

The committee satisfied themselves, that the charges upon the respective coals from the Tyne and Wear were as follows, viz.:—

			£.	s.	d.
Coal-owner, coals, and spoutage - -			0	15	3
Newcastle charges - - - - -			0	0	7
			0	15	10
King's duty, 6s.; other London charges, 2s. 4¼d.			0	8	4¼
Insurance, 2d.; loss on ingrain, 1s. 8d.			0	1	10
Freight - - - - - - -			0	9	8¾
			1	15	9
From the Wear—coals, &c.	16	3			
All other charges - -	10	2¼			
Freight - - - -	9	3¾			
			£1	15	9

That the present regulation had, with various interruptions,

Basin, as follows:—"The lowest range of seams are about 60 feet in thickness, will occupy an area of about 700 square miles, and would yield upwards of thirty thousand millions of tons of coal; yet it is probable, that not more than one-third of that quantity will ever be obtained from them. The upper seams, on the other hand, are capable of being worked to a greater extent, owing to their lesser degree of inclination, and the more moderate depth they attain. Under all these circumstances, it may be estimated as an approximation, that the quantity of workable coal does not exceed sixteen thousand millions of tons."

The annual home consumption he reckoned at - Tons.	1,850,000
The coals and culm exported for Wales in the year 1828, was - - - - - - - - - - - - -	904,896
Total - - -	2,754,896

continued since 1771; but they did not, in their report, express any decided opinion as to legislative measures, other than with regard to the metage and whipping, which laws they recommended to be amended.

The committee expressed their regret at the waste incurred by screening, and the consequent increase of price upon that account, inasmuch, as the same coal unscreened can be sold for 5s. per chaldron cheaper than when screened.

They recommended weight to be adopted instead of measure. With regard to interference with the regulation, they added that "the trade had better be left to the control of that competition which appears already to have affected it."

The committee conclude, by advising the removal of all duties on coal consumed in this kingdom, whenever financial arrangements can be made for effecting such removal with security to the public revenue.

SECTION VIII.

PARLIAMENTARY ENQUIRY IN THE YEAR 1836.

In 1836, a great sensation was produced in the trade, by the projection of two joint stock coal companies, with capitals of half a million of money, viz.:—The Durham County Coal Company, and the Northern Mining Company, accompanied by a bill in parliament for extending the Clarence Railway, by the Byer's Green Branch, across the River Wear, and into the unexplored district of Roddymoor, Willington, &c., to be called the South Durham Railway, a tract known to possess large unopened fields of good coal. Clamours were at the same time raised in the metropolis against the alleged coal monopoly, which clamours were not a little increased by a determination of the coal-owners to oppose, with all their might, the said South Durham Railway, upon the principle that not only was it uncalled for, but that it was a manifest injustice to grant parliamentary rights for coal railways, to the injury of private property embarked in wayleaves.

Tho excitement run high, and produced a motion from

Joseph Hume, Esq., for parliamentary enquiry into the state of the coal trade and its regulations.

Amidst an extensive mass of evidence collected by this committee, from the examinations of Messrs. R. W. Brandling, Buddle, Thomas Wood, Morton, and Matthias Dunn, the following may be taken as an abstract of the principal topics.

1833.—The coal trade was open, during which time best coals became so great a drug upon the market, that the owners could hardly realize 18s. per chaldron for them.

1834.—Regulation recommenced on the 1st March, at 26s. 6d., soon afterwards raised to 28s. 6d., and gradually to 30s. 6d.

Ratio of actual vend per 1,000 upon the basis, as also prices per chaldron of best coals, during eight years, ending 1835:

	Vend.	Wear Stewart's Wallsend.	Tyne Bewicke's Wallsend.	Tyne Vend Tons.	Wear Vend Tons.	Tees.	Hartley and Blyth.
1827	720	36s. 6d.	34s. 6d.				
1828	811	34s. 6d.	31s. 6d.				
1829				Free trade.			
1830	835	34s. 6d.	31s. 6d.	1,932,050	1,205,930		
1831	840	34s. 6d.	31s. 6d.	1,865,520	1,118,042		
1832	730	34s. 6d.	31s. 6d.	1,682,649	1,196,347		
1833	Open trade	24s.	22s. 0d., open trade up to March 1, 1834.				
1834	645	26s. 0d.	24s. 0d.	1,560,770	919,443	261,244	101,223
1835	768	28s. 0d.	25s. 0d.	1,849,021	1,183,108	299,293	133,184

In 1834, the basis of the Tyne was 4,809,824 tons; and the Wear 3,314,098 tons.

The number of collieries in the years 1829 and 1835 respectively, was as follows:—

1829.		1835.	Basis in Chald.
41	Tyne - -	47	959,500
8	Wear - -	9	564,000
—	Tees - -	16	176,000
49	Hartley & Blyth	4	53,250
		76	1,752,750

The actual vend was 76¾ per cent., or 1,346,112.

Lord Durham's collieries this year vended 127,269 chaldrons, = 768 per cent.

The collieries being at the same time capable of producing twice or thrice the required vend.

The new collieries in course of opening, were stated to be capable of raising a million of tons annually, viz.:

NEW COLLIERIES IN THE COURSE OF WINNING.

WEAR.	Tons.	TEES.	Chald.	Tons.
Thornley	79,500	Crowtrees	12,000	
Haswell	106,000	Coxhoe	30,000	
Belmont	47,700	Evenwood	20,000	
Whitwell Grange	53,000	Woodhouse close	20,000	
Haswell new pit	106,000	Coppycrook	15,000	
South Hetton	106,000	Deanery	20,000	
Monkwearmouth	53,000			
			117,000 =	310,050
	551,200			
TYNE.				
Pelton	47,700	Wear		551,200
West Townley	39,750	Tyne		87450
	87,450			948,700
Kibblesworth, Leazes, Stormont, &c.				51,300
				1,000,000

Basis, 1836.—Tyne, 1,000; Wear, 564; Tees, 176; Hartley, &c., 75. Total, 1815.

The basis upon which the Tees collieries formed the regulation in March 1, 1834, was 150,000 chaldrons; March 1, 1835, was 160,000; and Jan. 1, 1836, was 176,000.

Exports from the Tees.

	Tons.	
1826	18,588	
Year ending June, 1828	54,290	
Ditto, 1829	46,216	open trade.
1831	151,262	
1832	281,960	
1833	326,000	6 months' open trade.
1834	285,765	8 do., till Mar. 1, 1834.
11 collieries, 1835	357,726	

All these coals came down the Stockton and Darlington Railway.

In 1836, the Clarence Railway was in operation, and the power of the Tees in that year was half a million of tons. Thus, from 1828 to 1836 inclusively, the aggregate capabilities of the district had sprung from 5,941,812 tons to 9,623,922, being an increase of 3,682,110; and the price of best coals was 25s. on board ship.

The relative powers of working, as between 1829 and 1836, were stated to be as follows:—

1829 Coll.			Sept., 1829. Tons.	Coll.	June, 1836. Tons.		Increase.
41	Tyne ..	54·3 per cent.	3,110,936	47	4,809,824	=	1,693,888
8	Wear ..	19·5 per cent.	2,776,586	9	3,314,098	=	542,512
49		36·9 per cent.	5,887,522	56	8,123,922	=	2,236,400

The power of Hetton colliery was stated at 150,000; in 1833, it vend was 168,000; and, under the regulation, it is 110,000. The powers of Lord Durham's collieries were 150,000, and under the regulation they are also 110,000. The aggregate vend in 1835, for all the collieries within the regulation, was only 3,459,207 tons, whilst the powers on the Tyne alone were 8,123,922 tons; shewing that all the collieries are capable of producing three times the quantity which the regulation permits to be issued.

Total vends from the regulated collieries, in the year 1835, were—

	Tons.	
Tyne - -	1,849,621	
Wear - -	1,183,109	
Tees - -	299,293	
Hartley and Blyth	133,184	
	3,495,207	= 20¾ per cent. increase.
In 1834	2,892,671	

A considerable amount of evidence was given on the subject of wayleaves, shewing that the tonnage rates varied from 1d.

per ton per mile, up to 3d., and the certain annual rents upon some of the recently taken public lines, varied from £200 to £500 per mile per annum for unlimited quantities of coal and merchandise.

The rate of coal freights from Newcastle to London, were—

From year 1818 to 1821, 9s. 8d. to 11s. per ton.
1826 to 1831, 7s. 7s. to 9s. 1d. per ton.
1832 to 1835, 7s. 3d. to 7s. 11d. per ton.

Alteration of Duties.

1832. By act of parliament, the mode of buying and selling coals had been ordained to be done by weight instead of measure, and heavy penalties enacted for selling one coal for another.

The oversea and coasting duties had also been repealed, which gave an extraordinary impulse to the trade.

The duties upon coal sent to the colonies, 18s. per chaldron, had been repealed, and to reciprocal foreign countries it was reduced from 5s. 9d. to 3s. 4d. per chaldron. Do. in foreign ships, from 10s to 4s. per chaldron.

In consequence of the reduction of these duties, the export trade had increased as follows:—

	Tons.
1828	357,864
1830	514,419
1835	736,060

1831. The Duke of Richmond's shilling per chaldron was also abolished, the Treasury having purchased it for £19,000; although upon the average of 10 years, ending 1799, it amounted to £21,000 per annum, the purchase money was £728,333—from 19th August, 1799, to 1st March, 1831, it had amounted to £1,043,856, being an average of £33,264 for 31 years. In the month of March, the whole of the coasting duty, 6½d. per London chaldron, was also discontinued. So that the whole tax on seaborne coals remained 13d. per ton, payable to the Corporation of London; also 6d. and 4d. per ton to London Bridge, until 5th July, 1858.

	Tons.
The supply from Scotland was, on the average of 4 years, ending 1831 - - - - - -	89,321
Average do. 4 years, do. 1835 - - - -	145,159
Increase	55,838
The supply of London by inland navigation may be said to be at an end, being in 1834, only -	1,862
From Wales and Yorkshire, average of 4 years, ending, 1831 - - - - - - -	227,337
Ditto 4 do., 1835 - - - - - - -	261,732
Increase	34,395

The Welch culm has decreased 19,338 tons in that quantity.

Result of carrying Coals to London, May 1836.

				£.	s.	d.
Purchase of coals, 112 chaldrons, at 28s. 6d.				159	12	0
Night office and entry -	0	4	6			
City dues, 1s. 1d. per ton	16	2	10			
Metage, 293 tons, at 3d., half borne by ship-owner	1	16	7			
				18	3	11
Freight, discount, scorage bill stamp - -				9	6	6
Factorage 3s., and commission - - -				5	4	2
Insurance and duty - - - - - -				1	6	6
				193	13	1
Half metage - - -			1½d.			
Delivery of cargo - -			9d.			
				10	19	9
			10½d.			
				204	12	10
293 sold for 21s.				307	13	0
Equal 7s. per ton freight				103	1	2

The cost of transit from the collieries on the Tees to shipboard, ranges from 2s. 10d. to 3s. 9½d. per ton.

The price of coal ranging from 10s. 2d. to 6s. 9d. per ton.

Witton Park is 29 miles distant, and the railway dues cost 4s. 4d. per ton.

The committee is satisfied that the repeal of the export duty was judicious.

Account of coals imported into London, from 1828 *to* 1835, *inclusive*:—

	4 Years 1828-1831. Tons.	4 Years 1832-1835. Tons.	Decrease. Tons.	Increase. Tons.
Newcastle - - - -	5,178,255	4,641,724	536,531	
Sunderland - - - -	2,241,207	2,455,663		214,456
Stockton - - - -	110,413	795,765		685,352
Blyth and Seaton Sluice -	257,568	226,941	30,627	
Inverkeith and parts of Scotland	89,321	145,159		55,838
Swansea and do. Wales -	126,799	148,988		22,189
Hull, Goole, and Yorkshire	100,538	112,744		12,206
	8,104,101	8,526,984	567,158	990,041
No. of ships	27,856	29,967		

The bill for the Stockton and Darlington Railway passed in 1825.—The Clarence in 1832.—The Hartlepool in 1834, as well as the Blaydon and Hebburn, the Durham Branch to Hartlepool, and others, which have had the effect of reducing the price of coals in 1836, as compared with 1830, 4s. 9½d. per ton; or from 24s. 4d. to 19s. 6d. per ton in 1836.

On the subject of remuneration in the winning and carrying on of collieries, the following hypothetical statement was given by Mr. Matthias Dunn:—

Suppose a deep colliery, under a 31 years lease, to cost - - - - - - -		£100,000
Engines, railways, and positive stock	£30,000	
Worth at termination of lease -		20,000
To redeem		£80,000

As the amount of £1 per annum, for 31 years, reckoned at 4 per cent. per annum, will amount to £60, it will require to redeem the said sum an annual deposit of £1,333, being 1¼ per cent. on the original capital; and supposing the colliery to vend 40,000 per annum, it is 8d. per chaldron.

If the same capital is to be redeemed in 21 years, it will require £2,500, or 2½ per cent. per annum.

Therefore, redemption of capital, say,	2 per cent.
Common interest	5 per cent.
Additional mining profit	7 per cent.
Rate of expectation	14 per cent. rebate.

And assuming current working charges at	19s. 0d.
Above interest upon original expenditure 5 per cent., £5,000 per annum upon 40,000 chalds.	2s. 6d.
	21s. 6d.
Aggregate cost, say	22s. 0d.
Present selling price	26s. 6d.
	4s. 6d. profit,

Will equal 9 per cent. upon the original investment. If the vend be less, the annual profit will be reduced in proportion.

The first regulation the Hetton colliery joined, was in 1824–5.

In 1826 there was no regulation.
1827–28 there was a regulation.
Portion of 1829 was open trade.
1830, 1831–32 there was a regulation.
1833 was open trade.

"Mr. T. Wood is of opinion, that three or four of the best classes of coals can supply the vend exclusively, from their powers of production; and that a price, which would remunerate them, would completely exclude the inferior coals from the market." "Would say, that 24s. 6d. for the best, and 20s. 6d. for the second sort, would remunerate very well."—9s. 2·9d. and 7s. 8·8d. per ton.

Hetton vend was, in 1833, 168,000 chaldrons; its general powers are now stated at 150,000. It is 110,000 under the regulation.

1827 and 1828.—Price of best coals was 36s. 6d. on board ship; whilst, during the open trade of 1833, they did not leave the coal owner more than 18s.

Every successive regulation has been enacted at a lower rate.

"Mr. Wood did not think that the continuance of open trade would depend upon the great coal owners, nor because a great coal owner had coals, he could drive the others out; but those who could produce the best coal cheapest would command the markets."

"I have always given this opinion, that the best coals would, if sold at 24s. 6d., ultimately command the whole of the market; that is, the best coals, comprised in which, there are 20 or 30 different kinds of coal."

Mr. Wood said, "the then prices left an extravagant profit to the coal owner, and had been one of the causes of the strike amongst the workmen." Mr. Buddle, on the contrary stated, that "there had been less trouble with the workmen since the regulation, than before."

The committee reported, that notwithstanding the repeal of the duties, the regulation of the vend had not been abolished, as anticipated by Mr. Brandling, in his answer to the committee of 1830; but they were satisfied that the reduction of the export duty was judicious, inasmuch as it had greatly increased the trade of both collieries and ships.

That the whole system of combination was worthy the attention of parliament, in the hope that measures might be devised, to prevent such inconveniences to the trade.

The committee could not come to any precise opinion as to the rate of profit derivable by colliery owners, nor upon which legislation could act; their evidence being unsatisfactory upon this point.

			s.	*d.*
By the statement of prices, of 28 sorts of coals at the ports of shipment, there has been a reduction of, - - - - - - per ton.			1	3⅛
King's duty - - -	4	8⅜		
Charges in the Pool -	0	5⅜		
			5	1¾
Carried forward - - -			6	5½

	s.	d.
Brought forward - - - - - -	6	5¼
Charges which apply to the ship - - -	0	8¾
In all	7	2
Also to the consumer's cellar - - - - -	4	0
Should give to the consumer an advantage of over the charges of 1830.	11	2

But Mr. Wood has stated, that "with an open trade, the best coals would be supplied 4s. per Newcastle chaldron, or 1s. 6d. per ton cheaper than they now are." And by the estimate of a joint stock company, 4s. per ton may be further reduced, if the "28 Geo. III. is repealed;" so that a reduction of 16s. 8d. per ton to the consumer may be effected, as compared with the prices of 1830.

The committee terminate their report, with recommending "that every means of promoting a new supply be encouraged, as furnishing the most effectual means of counteracting the combinations of the coal owners and factors; and that the said act of Geo. III. be repealed, so as to leave the coal trade free in the port of London."

SECTION IX.

REPORT OF THE SOUTH SHIELDS COMMITTEE UPON ACCIDENTS IN COLLIERIES, THE RESULT OF THEIR INVESTIGATIONS AND SUGGESTIONS, WITH REMARKS AS TO LEGISLATIVE INTERFERENCE.

During the year 1839, in consequence of several successive explosions in collieries, especially a very fatal one at St. Hilda's pit, South Shields, on the 28th of June, in that year, whereby 52 lives were lost, a committee of enlightened and praiseworthy individuals, composed of Robt. Ingham, Esq., President; Thomas Winterbottom, Esq., M.D., Richard Shortridge, Esq., J. P., James Roxby, Esq., J. P., John Clay, Esq., Errington

Bell, Esq., Robert Swinburne, Esq., William Eddowes, Esq., and Anthony Harrison, Esq.; having for their secretaries, James Mather and Thomas Salmon, Esqrs., undertook to investigate the causes of the accidents in collieries, and the means at present in use for obviating them; and having also in view the discovery of what might still be wanting to effect, as far as possible, so humane an object.

It is impossible to speak too highly of the practical and talented report published by the above parties; suffice it to say, that it is clear of all the extraneous matter attendant upon the many idle theories launched by would-be philosophers, upon a subject which they have scarcely ever examined, much less understood. These gentlemen descended into the working collieries, ascertained the extent and effect of the various practices, not only of ventilation, but of the use of the safety lamp, and every other means resorted to in a district, which is universally admitted to stand pre-eminent in the theory and practice of coal mining. And, I have only to regret, that it is not within the compass of this little work, to do more than briefly extract some of the most important subjects which came under their notice, and to tender my meed of approbation of this very useful investigation.

They commence their report by stating, that within the last twenty years, the districts of the Tyne and Wear have had upwards of 680 miners destroyed.

They then advert to the probable duration of this coal field, as given in evidence before parliament, &c., with a view of impressing upon the government the necessity and policy of legislating, so as to prevent needless waste.

In this department of the subject, they very properly distinguish between the actual existence of coal "and the *cost* of working it, as compared with other districts, whether in this country or the continent;" concluding, that after the profitable coal is worked away, the district may be said to be exhausted. Upon this subject they conclude, "It is then important, not only for the sake of humanity, but for the continued prosperity of Britain, that the hope of the future be not sacrificed to the interest of the present, and that a *safe, economical, and well-*

arranged system of working those mines be established. Hitherto, they have been left only to chance, and the unassisted efforts of individuals."

The direful effects of a general explosion, such as that which immediately led to the appointment of the committee, are well pourtrayed, and are calculated to leave a lasting impression upon the mind. They may be shortly described as follows:—

The paraphernalia of a large coal work in the north of England, consists of extensive railway passages, doors, stoppings, brattices, rollies, tubs, horses, timber, with numerous men and boys; and the effect of a general explosion is so to derange and disfigure every avenue, together with the extinction of lights, that persons best acquainted with the works, and possessed of all their faculties, cannot wend their way to the place of escape; but no sooner is the explosion over, than the mine is filled with after-damp or azotic acid gas, which takes the place of the atmospheric air and produces certain death, if the unfortunate individuals do not succeed in instantaneous escape; for, by the demolition of the stoppings and doors, the atmospheric current can no longer reach them. The effect of this deleterious vapour first affects the brain, then the limbs; and, although persons are comparatively sensible, yet they are incapable of urging their way. The disarrangement of the mine, and the prevalence of azotic gas, at the same time prevent the access of persons, plenty of whom are always found ready to risk their lives in the attempt to save the sufferers; but they cannot approach until ventilation is somewhat restored by the temporary application of brattices, doors, stoppings, &c., so that it is frequently many days, or weeks, before the choke damp can be driven off sufficiently to render approach practicable; and it is no uncommon occurrence, that rash or inconsiderate individuals lose their lives in making ineffectual attempts before the mine is sufficiently cleansed. During these casualties, the use of the safety lamp is invaluable, and is often instrumental in saving life, which would be otherwise lost.

In order to test the degree of safety furnished by the Davy or safety lamp—the committee ascertained, that the inflammable gases contained in coal mines are four in number, of various degrees of density and inflammability, viz.:

1. Light Carburetted Hydrogen—which will explode at the flame of a lamp, or candle, or vivid spark, heated metal, or at electricity; specific gravity 0·5382, being about half the weight of common air.

2. Olephiant Gas, or Heavy Carburetted Hydrogen; specific gravity 0·9722.

3. Sulphuretted Hydrogen; specific gravity 1·1805—probably arising from the iron pyrites, which are abundant in some mines, and which give out the gas freely under ordinary temperature when wet. This gas takes fire at the least visible heat of iron; and, therefore, at a red hot safety lamp, would explode.

4. There is another gas, the produce of explosion, often also abundant in old workings—it is called carbonic acid gas, stythe, choke damp, black damp, &c.—a single breath of which *pure* is almost certain death. In this gas, lights will not burn. Its specific gravity is 1·5277, and it is generally found on the floors of the mines, whereas the lighter gases are found next the roof.

The steel mill was the first means used to carry on operations, where the discharge of one or other of those gases had so far adulterated the circulating current as to render the candle unsafe; and the various descriptions of safety lamps have followed. And although abstractedly safe, innumerable instances stand recorded of explosions taking place under the use of these lamps, as well as the steel mill. Many pages of this valuable report are devoted to this department of mining, but into which it is not my province to enter, further than to say, that no lamp can ever by possibility be invented, which is not liable to accident or mismanagement under an explosive atmosphere. The committee, therefore, in turning their attention to the ventilation department, wisely conclude that it is to a *perfect ventilation* that real safety must be looked for; and it is much to be feared that a dependance has been placed upon the safety lamp, to the detriment and neglect of ventilation.

"The average velocity of the air, through the passages of the mines (says the report), on the present system *in the north*, does not generally exceed 3 feet per second—in many instances, where the mine is most dangerous, it is much less."

The first example of ventilation cited by the committee "has upwards of 70 miles of passages, and has only one pit 13½ feet diameter, for ventilation, drawing coals, pumping water, and every operation necessary between the surface and the works—the said pit being also 850 feet deep."

The total quantum of air passing through the mine was 30,000 cubic feet per minute—if confined to one column, it would require 16 hours to travel through the whole mine; but the air is split into two great columns, 2-3rds going to a more distant working, and 1-3rd clearing the passages in a different direction.

The whole column, previously to splitting, moves with a velocity of 435 feet per minute, area 64½ feet. The 2-3rds amounts to 19,500 cubic feet, and the 1·3rd in the same area is reduced in its velocity to 300 feet per minute; but in coursing through the pannels of workings, it is again subdivided into three parts, each 90 feet area, and there its speed is reduced to 66 feet per minute, or 1·1 feet ⅌ second, through 5·7ths of the entire mine.

With this description of ventilation, the committee conclude that explosions are unavoidable, and that it is inherently inefficient.

The committee discovered, that in several mines the current did not exceed 1 foot per second in the boards or main workings. In the fourth example cited in the case of a pit 1580 feet below the surface, the chief air course travelled with a velocity of 7 feet per second, area 36 feet—the temperature of the mine was seldom below 80 deg.

The committee conclude this branch of their report, with the opinion "that the shafts are *too* few, and the speed of the air too limited to remove or fully dilute the gas;" and that more shafts and more air are the only remedies.

The evils arising from single shafts dependant upon brattices are set forth, the said brattices being liable to be blown out during explosions.

The committee cite the evidences of persons before the parliament committee of 1835—and amongst the rest, of Mr. Geo.

Stephenson, who says, "It does appear to me that an act of parliament might be obtained, to have power to cause certain regulations to be attended to in the ventilation of mines."

The committee came to the conclusion, that in consequence of the increased expansion of the current, = 1-7th, the upcast shaft ought to be proportionably larger than the downcast, and that it was, generally speaking, the contrary.

The committee entertained a high opinion of the suggestion of Mr. Gurney, as to introducing a continual jet of steam, 40lb. per inch into the upcast shaft, either as a substitute for, or assistance to the furnace ventilation. Mr. Gurney's opinion is, that it would be effected at as cheap a rate as the furnace ventilation.

In the investigations of the committee, they have not overlooked Mr. Ryan's proposition of gas drifts, to be driven along the upper part of the coal-field, by which means the gas is expected to ascend naturally. Mr. Ryan seems to have introduced this system, in the shape of "top heads," in the thick coals of Staffordshire, about the year 1808, the said top heads extending from the workings to the upcast shafts. He conceives that a gas course will carry off the gas through solid coal of one or two miles in distance, provided there is no fault in the way; and the committee are so impressed with the utility of the discovery, that they urge its adoption wherever practicable.

The use of the barometer is justly recommended, inasmuch as the lightened pressure of the atmosphere, as denoted by the fall of the mercury, is sure to be followed by an extra discharge of gas from the orifices of the coal, and that instrument will indicate such expected fact.

The committee suggest the desirableness of a proper instrument for measuring the velocity of the current of air. And, with respect to the registering of maps, and records, they urge upon the government to bring about an official registration of plans, sections, &c., under similar arrangements as those used in France, Belgium, and other continental countries, not only for the preservation of life but also of property.

Upon the subject of government inspection, the committee express their regret that Great Britain should, of all other nations, leave her mining interests to individuals, without any supervision of the state. "Such inspecting officers (say the committee) would aid greatly in bringing the whole mining system into the best condition that the peculiarities of the various districts are capable of receiving; and so the country and humanity would be largely benefited by the results."

The medical treatment of persons suffering under the effects either of burns, or the deleterious effects of the gases, does not escape the research of the committee, upon which subject they cite the general rules of the French practitioners.

They conclude their talented report, by reiterating their conviction of the importance of "Government Inspection," under an enlightened public jurisdiction, after a similar manner to its legislation with regard to railways, factories, &c. To carry out which it is necessary to employ well informed, scientific, and practical inspectors, to pay frequent visits to the mines, and to the registration of official suggestions and recommendations, "with power, judicially, to enforce their execution and adoption."

Remarks upon the Report of the South Shields Committee.

The committee take a very just and proper view of the waste of coal, which ought, indeed, to be considered as a national subject, and one which necessarily raises the question as to the goodness or badness of each different system. The custom with many of the thin seams, especially in Scotland, is to work them with long wall, or, in other words, exhaust all the mine in progression, the goaves, or hollows, being stuffed up with the small coal, as well as the fallen roof, to aid the great quantities of prop timber, not only applied immediately adjacent to the workmen, but also in the roads from the shaft to the workings.

In some especial cases, this mode of working may be necessary and advisable; but in general it is productive of great waste; inasmuch, as the superior strata is continually pressing upon the face of the coal, and crushes it greatly into small. The board and pillar working, universally practised in the Newcastle district, consists (according to the hardness of the coal, and the depth from surface) of working away, in the first instance, from ¼ to ½ of the mine, leaving the remainder in oblong pillars, but which pillars are only intended to be left until the proper opportunity arrives of working them successively away, in which case a produce is realized, of from 7-10ths to 9-10ths, according to the depth and other circumstances of the mine.

In less practiced districts, the quantum of coal left in pillars, varies from 1-6th to 1-3rd; and when such pillars are left disproportionably small, they are irrecoverably lost, inasmuch as they will not repay the expense of removing the surrounding fallen roof.

Unless a seam of coal is especially circumstanced as to roof, thill, or band, long wall is a wasteful and unprofitable mode of working; indeed, it is next to impracticable, where the pressure is apt to extricate inflammable air, because there is no dislodging the gas by any well-guided ventilating current.

In working the 10 yard seam in Staffordshire, "the roads are driven 3 yards wide, the workmen then 'side lane off,' about 28 yards in length and 7 in breadth, forming pillars of 6 to 8 yards square, with wide openings of coal; between each of these workings is left a rib of coal, and the goaves or workings are then dammed up to prevent '*fire stink*;' in this way successive sides of work are carried on, leaving a fire rib between each, and so on, till all is cleared."

According to the opinion of Mr. Brook Smith, of Walsall, who has favoured me with the above, a produce of only 16,000 tons per acre is realized out of 48,000, the total content; and if inflammable air is produced, it cannot but be replete with danger thus to attempt to dam up or confine it.

The management of the safety lamp, in well regulated collieries, is entrusted to persons appointed to examine and see to their being right. To leave them to the charge of individuals without such check, is to incur endless risk; or to allow the ventilation of the mine to fall into dilapidation, because of dependence upon the safety lamp, is unpardonable.

Ample ventilation, no doubt, depends upon the adequate size of the downcast and upcast pits, as well as the chief passages of the mine, and the committee reason well in alleging, that the upcast should be greatly more capacious than the downcast shafts; and, although there is, and ought to be, a limit to the extent of mine ventilated by one shaft, yet we do not find, that in districts where the shafts are, beyond all question, needlessly numerous, that the ventilation is proportionably better, or the collieries safer than the deep ones; nay, oftentimes, the reverse, because they trust to a species of natural ventilation, and neglect to apply those means, that in the deep and extensive collieries are absolutely necessary.

With respect to increasing the ventilation by means of a continual supply of high pressure steam; I fear that it is not practicable at any ordinary expense. At Hebburn colliery, it was tried by Mr. Buddle; and, although some of the objections mentioned by the committee might apply to it, yet I fear much its practicability.

I cannot go along with the committee in thinking that any practical use can be made of Mr. Ryan's proposition of gas drifts. The coal seams, in many districts, are so unequal in their dip and rise, and so interrupted by faults, that to carry out the object at all, would be too costly, and, in most cases, impracticable. Common experience teaches, that the inflammable gas has a tendency to escape at the highest point, and we know, also, that when a set of workings are "forewon" by other workings, that the discharge of gas is lessened, and that when a coal mine is first broached, that the discharge is more profuse, than when it has numerous passages to escape at; but, we also know, that in districts where the coal rises rapidly to the surface, as in North Wales, that still the individual workings make gas, which can only be dislodged by ventilation.

In the working of the ten yard coal of Staffordshire, if the parties were so ignorant as to have the air drifts along the sole of the mine, leaving the upper parts to fill with gas, and if Mr. Ryan suggested that the said drifts should be made next the roof, undoubtedly he introduced a great improvement.

The registering of plans, and other statistical information, would not only, undoubtedly, tend to preserve both life and property, but would also furnish government with information relative to the mining resources of the country, of which they are now ignorant, and which information it is impossible otherwise to obtain.

Lastly, the committee conclude with the recommendation, that government should provide for regular inspection and legislation as to the general business of the mines, and in which I most cordially concur, if no other instance stood upon record than the Workington colliery, in Cumberland.

In the year 1837, the principal field of work in this extensive colliery, was in the main band seam, 10 feet thick, extended for 1,500 yards underneath the Irish sea, and rising rapidly towards the surface. A demand for coals had taken place, to supply which, increased working was carried on, the necessary pillars were abridged or wrought away, till, in a luckless moment, a crush took place, which let in the ocean. So well understood were the risks that were running, and so strong were the fears of the workmen, that a disaster of this sort would happen, that many of them left the work. The subject was a matter of common conversation about the town; but a fatal confidence in the manager silenced the fears of the proprietor, until, alas! it was too late; and the lives of 36 men and as many horses, and the whole stock and resources of the colliery were irrecoverably lost.

Great were the murmurs both before and after the catastrophe; but in consequence of a defect in the law, no coroner's jury could sit to inquire into the circumstances, since none of the bodies could be had. No one can doubt, that under a district inspectorship, this calamity would have been averted.

In the month of February last, a very similar and equally lamentable catastrophe occurred at Landshipping, in the county of Pembroke, where by the sudden inundation of the river under which the colliery was working, no less than 40 men and boys perished, as well as the instantaneous filling with water of the whole of the extensive works.

It is said, that in those parts of the workings where the accident occurred, only a few feet of rock, underneath twenty yards of sand, separated the waters of the river from the bed of coal; that the workings had for some time previous been discontinued in that quarter, but that in an unfortunate moment they had been resumed, and the obvious consequence followed. So slight, indeed, was the separation from the waters, that the very timbers of the mine arose through the fractured part, and were seen floating around the spot.

It is a question if ever these works will again be drained; but, until then, no coroner's jury or other legal tribunal can call in question the prudence of working under the circumstances. Need there be stronger grounds shewn for legislative interference?

SECTION X.

PARLIAMENTARY ENQUIRY IN THE YEAR 1840.

DURING the session of 1840, in consequence of the repetition of mining accidents in different parts of the country, and especially in the north of England, notwithstanding the introduction of the Davy lamp, Lord Ashley, actuated by that love of humanity that had previously distinguished him in regard to the regulation of the treatment of the factory children, undertook to bring a bill before the House of Commons, for an enquiry into the state of the people employed in the mines, having for its object not only the correction of abuses in the employment of women and children, but also with the laudable object of enquiring into, and devising means for preventing those appalling disasters in future.

After much discussion, and no little opposition from persons who fancied that parliamentary investigation would operate against their private interests, the two houses of parliament granted a commission of enquiry, which was afterwards made to consist of Thos. Tooke, Esq., J. Southwood Smith, Esq., Leonard Horner, Esq., and Robt. I. Saunders, Esq., under the following letter of instruction:—

"GENTLEMEN,—The Queen having been pleased to comply with the prayer of an humble address, presented to her Majesty, in pursuance of a resolution of the House of Commons, dated 4th Feb., 1841:—'That Her Majesty will be graciously pleased to direct that the commission appointed, in answer to an address of this house, on August 4, 1840, for the investigation of certain branches of infant labour, do include within its enquiry the labour also of young persons, designated as such by the provisions of the Factory Act.'

"I am directed by the Marquis of Normanby, to desire that you will include within your enquiry the labour of young persons, designated as such by the provisions of the Factory Act accordingly.

"I am, Gentlemen,
"Your obedient servant,
"F. MAULE."

To work out the object of this commission as speedily as possible, sub-commissioners were appointed, who visited the mines personally, inspected the underground arrangements, examined the work-people, and possessed themselves of a great mass of evidence, embracing every department of mining in Staffordshire, Shropshire, Warwickshire, Leicestershire, Derbyshire, Yorkshire, Lancashire, Cheshire, Cumberland, Durham, Northumberland, Scotland, Wales, Gloucestershire, Somersetshire, and Ireland.

The commissioners concluded their report upon the 15th Feb., 1841; proceedings thereupon followed in parliament, and an act was passed, Aug. 10, 1842, embracing the following provisos:—

1. That from and after the passing of this act, it shall not be lawful for any owner of any mine, or colliery, to permit any female to be employed therein, other than such as were at or before the time of the passing of this act employed within such mine or colliery. And that after three months from the passing of this act, no person shall be employed who shall be under the age of 18 years; and any female under indentures of apprenticeship, shall, after the space of three months from the

passing of the act be perfectly free. And from and after the 1st day of March, 1843, it shall not be lawful to employ any female whatsoever underground; and all contracts relative thereto, shall be void after the said 1st day of March, 1843.

2. That from and after the 1st March, 1843, no male person shall be employed, who had not at the time of the passing of the act attained the age of 9 years.

3. That it shall be lawful for one of her Majesty's principal Secretaries of State, to appoint any proper person or persons to visit and inspect any mine, or colliery, who shall be entitled to require all suitable powers and facilities from the owners or occupiers of the said mine, to enable such person or persons to visit and inspect such mines; and such person or persons shall report the state and condition of the persons working in such mine, or colliery, and whether or not the provisions of this act are properly observed in the mine or colliery which he shall inspect.

4. That from the time of passing this act, no person shall take any apprentice who shall be under the age of 10 years, or for a longer apprenticeship than 8 years, except as the apprentice of a joiner or other aboveground business; and any indenture of apprenticeship, whereby any person shall hereafter be bound contrary to the provisions of this act, shall be void; and when any person now serving under articles of apprenticeship, within any mine, or colliery, shall attain the age of 18 years, he shall be discharged from such apprenticeship, and the articles shall become null and void.

5. Penalty for offending against any of the aforesaid provisions not exceeding £10, or less than £5.

6. Any parent, or guardian, misrepresenting the age of a boy, a penalty of 40s. to be payable.

7. Nothing hereinbefore contained shall prevent any person whatever being employed aboveground.

8. Provides that where the entrance shall be by a vertical pit, or shaft, or inclined plane, the person having charge of the machinery shall not be less than 15 years of age, whether driven by steam engine, other engine, windlass, or gin; and that in case of any of the ropes, chains, or other machinery, being put

under the charge of a person under 15 years of age, a penalty to be incurred not exceeding £50, and not less than £20.

9. That in case the said windlass, or gin, is worked by horse or other animal, then the owner of the said horse, &c., to be deemed and taken to be the person having charge thereof.

10. That after the expiration of three months from the passing of the said act, no person to be paid at any public-house, but if made, such payments to be held void.

11. Wages so paid to be recoverable, same as if no such payments had been made.

12. Owners and agents of mines so paying money, to be liable to a penalty for every offence of not exceeding £10, and not less than £5.

13. In case an agent, or contractor, shall so pay money without the order or knowledge of the owner, then to be subject to the said penalty, the same as if he were the owner.

14. The term owner to mean the immediate proprietor, or lessee, or occupier; and the word "agent," and "servant," to be taken to mean any person receiving a salary, wages, payment, or remuneration for service done.

15 and 16. Facilities of summons.

17. Penalties to be levied by distress of goods, under the warrant of two justices, or under the hand of a sheriff; said warrant to be issued under the oath of one or more creditable witnesses. Penalties, after paying expenses, to be paid one-half to the informer, and the other half to the overseers, or managers of the poor of the parish, or township, where the offence has been committed, in aid of the poor-rates, &c.

18. In case of refusal to pay penalties, said parties to be imprisoned in the gaol or house of correction, with or without hard labour, for any time not exceeding two months. Commitment to be determinable upon payment of penalty and costs.

19. All inhabitants to be competent witnesses.

20. Remedies by action, for levying distress informally or unlawfully, in case of refusal to make sufficient awards for any action; but in case of paying into court a suitable payment for such unlawful distress, the said action to be stayed.

21. Right of appeal to the quarter sessions against conviction of magistrates within 15 days, such person giving to the complainant a notice in writing of such appeal, and of the cause and matter thereof, within 7 days after such conviction, and 7 days at least before such session, &c.; the decision of such quarter sessions, to be final.

22. Convictions not removable by certiorari.

Children's Employment Commission.

In handling the voluminous matter resulting from the detailed evidence adduced by the sub-commissioners, it is not my intention to dive deeper into the subject than is sufficient to bear out my own observations as to the health and safety of the people, coupled with the economic and effective working of the mines. I therefore pass over, without notice, the chapter devoted to the ages and sexes of the individuals employed in the different districts; and stop for a moment, at the 5th chapter, which treats upon the general height of the working places, with the nature of the ventilation, and consequent temperature.

Height of Roads.—The committee justly observe, that no coal mine can be comfortably worked "whose main roads are less than from 5 to 6 feet, and the side roads less than 2½ feet;" and they cite a good deal of evidence to shew, that many collieries are carried on below these standards, consequently requiring the employment of very young operatives.

In this respect, it is notorious that in proportion as the collieries are conducted by skillful persons, so are the roads made commodious for the application of small ponies or putters; and in the Newcastle collieries, be the height of the seam what it may, artificial height is always provided up to the standard of 3½ feet, and the horse roads from 5 to 6 feet.

It is also considered sound economy to supersede the tram by horse roads, whenever the workings have extended themselves 150 or 200 yards average distance from the shaft or depôt.

With respect to the sort of carriage by which the coals are conveyed along these low passages, in many districts they use sledges, which are both oppressive to the workmen and wasteful to the proprietor.

Ventilation.—Upon the subject of ventilation, the committee describe the general principle to be, "the guiding of the current from the downcast pit through the main passages of the interior workings; the said current to be accelerated by means of a fire, situate at the bottom of the upcast shaft."

They observe, "*that in some districts every precaution is taken which intelligence and skill can devise, to render the mine healthy and safe; but there are great numbers of mines, in which both ventilation and drainage are grossly neglected, and in which, as a necessary consequence, there is often a frightful destruction of human life.*"

Ventilation may become inefficient, not only because the main current is not sufficiently stimulated by the furnace application, or that the passages are not preserved sufficiently spacious for the desired purpose; but, also, because the column is not sufficiently guided into those parts of the mine where the gas is apt to accumulate; or, because, there is no adequate system of carrying off the said gases, by subdivided columns of air, into passages apart from those traversed by the ordinary workmen.

The want of such arrangements produces unhealthy air, from the inordinate mixture of noxious gases, and also, hurtful temperature, because of the insufficient supply of atmospheric air; and, as the natural temperature of the earth increases in proportion to the depth, so the deep collieries require more perfect ventilation than the shallow ones, especially as the shafts (because of the expense) are necessarily less numerous. However ample the column of air may be at Monkwearmouth colliery, the temperature is rarely below 78 degrees.

Upon the advantages of a good ventilation, Mr. Woodhouse, of Overseal, in Derbyshire, instances "*the improved system adopted in the collieries on the Tyne and Wear of dividing the workings into districts, and so obtaining a current of fresh air in every division; in pits, with a rapid circulation of air, the men respire freely, the road ways are kept dry, and repaired at less expense, and the timber lasts longer by years; and,* *therefore, it is strict economy to ensure a good ventilation. In some mines the air can scarcely be perceived to move at all, a thick mist or fog pervading the whole pit, forming an atmosphere, which has the effect of shortening the days of the colliers.*"

The sum and substance, therefore, of the evidence in these two particulars, are—

1. That the length and lowness of the tram roads are, in many cases, under the most oppressive arrangement.

2. That the ventilation throughout a great part of the Midland district, is either devoid of principle, or under the most inadequate state of management, fatal to the *health* of the individuals, if carbonic acid gas is generated, and where inflammable gas prevails, destructive of their lives.

Whilst it seems the opinion of all the reporters, that good and scientific measures would, to a surprising extent, relieve the workers, and economize the general charges of the mine.

Accidents.—By the report of the select committee of the House of Commons, in 1835, it came out in evidence, "*that during the* 18 *years previous to the introduction of Sir H. Davy's safety lamp, in* 1816, *that the loss of life in the counties of Durham and Northumberland, by explosion, was* 447; *whereas, during the* 18 *years succeeding* 1816, *the loss of life was* 538, *occasioned not only by an increased quantity of working, but by an increased quantum of risk, occasioned by the working of fiery collieries, inaccessible previous to this invention; at the same time it was inferred, that because of the use of the safety lamp, many precautionary means of safety previously practised, were abandoned.*"

The committee observe, that it is "the bounden duty of owners, carefully and constantly, to examine into the state of their mines."

Upon this part of the subject, I take leave to observe, that the great safeguard in the use of safety lamps is their being maintained in proper order; and this cannot be done, except they are kept in charge of some person whose peculiar duty it is to see that all the lamps are perfect before the workmen are suffered to put them to use.

In many districts, however, the lamps are constantly in charge of each individual workman, who not only neglects but puts them to use without being checked or observed by any responsible person belonging to the property, thus not only endangering his own life, but that of all his fellow-workmen.

The committee transcribe, from the registrar's report, a very interesting table, of the violent deaths in 55 mining districts, in the year 1838, as follows:—

By falling down shafts	63
Breaking of ropes	1
During the time of ascending and descending shafts	10
Drowned	22
Fall of stones and coals	97
Various injuries in coal pits	43
Explosions of gas	88
Explosions of gunpowder	4
By trams and waggons	21
Total	349

The committee, without questioning the zealous and faithful discharge of the duties of coroners, suggest the propriety "of information being sent to the Secretary of State, in order that some fit and proper person should be present at, and assist the said coroners in their investigations.

I may here repeat the observations as to the deficiency of the inquest law, viz., that without the obtaining of a body, the coroner cannot summon a jury, nor can he report upon the case; as in the drowning up of Workington and Landshipping collieries before mentioned.

The adequacy of the machinery and materials, as also the providing of proper persons to watch every stage of mining, are necessary provisos towards ensuring the safety of the people.

The approach to old wastes, whether filled with water or gas, or the working under seas or rivers, especially calls for science and practical judgment; and for the power of appealing to some disinterested authority, in case of doubts being raised similar to the instances before mentioned; for had there been at that time any legitimate authority to appeal to, there is no doubt but that both the property and the lives of the people would have been saved.

The committee, upon the 6th article of the report, express themselves as follows :—

"That in many instances, much of that skill and capital can effect to render the place of work unoppressive, healthy, and safe is done, often with complete success, as far as regards the healthfulness and comfort of the mines; but that to render them perfectly safe does not appear to be practicable by any means yet known; whilst in a great many instances, their condition in regard both to ventilation and drainage is lamentably defective."

In article 22nd, "That there are mines in which the most ordinary precautions to guard against accidents are neglected, and in which no money appears to be expended, with a view to secure the safety, much less the comfort of the work-people."

It is impossible to read this report, the result of an immense accumulation of evidence, taken by persons wholly disinterested, without coming to the conclusion that something in the shape of parliamentary legislation is not only practicable but necessary.

The evils of the Butty system, or subletting to contractors, seem to have escaped the observation of the commissioners, inasmuch as their object in saving labour and material has an especial tendency to the disregard of those measures of safety constantly called for, and puts their individual gain in opposition to expenditure, which ought to be devoted to the safety and comfort of the people.

SECTION XI.

PECULIARITIES IN CERTAIN COAL FIELDS OF SCOTLAND, IRELAND, YORKSHIRE, LANCASHIRE, AND NORTH WALES; SECTIONS OF WORKING SEAMS, ETC.

Notwithstanding that the general nature of coal fields may be said to be very similar, yet many peculiar varieties exist, both as to the nature of the coal itself, and also as to many of the accompanying circumstances; and having, in the course of my professional practice, visited many of the coal districts in the kingdom, it may not be uninteresting to include in this tract, a notice of some of the peculiarities that have fallen under my observation.

It may be premised, that coal strata for the most part rest upon millstone grit, mountain limestone, or transition strata, and are more or less intersected by faults, throws, whin dykes, &c., and the strata which accompanies coal, always consist of argillaceous and silicious rocks, limestone, fire clay, shales, ironstone, or basalt. These rocks frequently thicken, and thin, so as often to unite seams in one locality, which are fathoms asunder in another; the coal-beds are also subject to be disfigured by bands of argill or shale; hence difficulty constantly occurs, of tracing them from place to place.

The object, therefore, of this section is, to bring under notice certain facts, which may be deemed peculiarities, as differing from the ordinary routine.

1.—*Newcastle Coal Field.*

The principal dyke or fault in this district, is a down-throw of from 90 to 130 fathoms perpendicular. Commencing from Grand Lease colliery, in the county of Durham, it passes through Denton, Gosforth, Killingworth, Backworth, in a north-easterly direction, into the northern ocean, previous to which, it becomes divided into two or more branches, one of which passes by Cullercoats; and it is owing to this downcast dyke, that the patch of magnesian limestone is thrown in at Whitley. This dyke is useful, inasmuch as the Wallsend and other seams, which had cropped out towards Newcastle, constitute afresh the important collieries of Gosforth, Fawdon, Wideopen, Cramlington, Seghill, &c.

The Heworth Dyke originates also at Grand Lease colliery, and passes down the south side of the Tyne, by Farnacres, Sheriff Hill, and Heworth, being an upthrow to the south of 25 fathoms; but it is not so remarkable on that account, as that a change of the quality of several of the seams is known to take place about its locality.

A 40 fathom dyke also pervades the Auckland district, stretching from the Bishop's Park, through the collieries of Counden, Thrislington, Cornforth, Garmondsway Moor, Trimdon, &c. These are all slip dykes, and are common to all coal fields, but seldom of such magnitude as the above.

Two or three remarkable whin dykes also traverse the district. The Coally Hill Dyke commences near Walbottle, passes through the collieries of Montagu Main, Benwell, Fenham, Town Moor, Shield Field, Byker, St. Anthony's, Hebburn, and is also traceable past the Brandling Junction railway station of Brockley Whins, and into the North Sea, near Whitburn.

This dyke has been frequently mined through in St. Anthony's colliery, where it presents the following section, passing from south to north.

	Ft.	In.
Cinder coal - - - - - - -	114	0
Sandstone - - - - - - -	0	6
Blue Whin - - - - - - -	9	8
Blue Metal, mixed with sandstone - -	6	8
Sandstone - - - - - - -	3	8
Blue Metal, mixed with sandstone - -	4	9
Blue Whin - - - - - - -	7	9
Cinder coal - - - - - - -	114	0
Total - -	261	0

The Cockfield dyke is first seen at Butterknowle colliery. It passes through Cockfield, Bolam, Low Hill, across the Tees at Preston, through Cleveland, by Cockhill Newby, and into the sea near Whitby—course, south 75 deg. east. It consists of a solid mass of blue basalt; and upon each side, the coal, for a great number of yards, is completely coked.

The Hett Dyke is proved at Willington, Tudhoe, Butterby, Croxdale, and Shincliffe, and is of a similar decription.

The Acklington Dyke, in Northumberland, passes through the collieries of Togstone, Radcliffe, and into the North Sea in an easterly direction; also of basaltic formation.

Sand Deposits.

The most remarkable sand deposits are found at Ouston colliery, near Chester-le-Street, and at St. Lawrence, near Newcastle.

The former is traceable from the neighbourhood of Harbour House, near Durham, past Chester-le-Street, and down the Ravensworth valley, through the collieries of Ouston, and Urpeth. In its course, the upper seams of coal are denuded, but the lower seams are not affected.

A very remarkable gravel bed has also been proved at St. Lawrence colliery, an account of which I laid before the Natural History Society of Newcastle; it reaches to the depth of 20 fathoms, and underneath the bed of the river Tyne, in many parts, it takes the place of the Wallsend seam; in other cases, it divides certain portions of it; and sometimes it forms the roof. It is composed of sand and rounded stones, having every appearance of having once been the bed of a brook. Its extent has not been proved, but it consists of several acres. The lower seams have been worked underneath it, and are not at all affected.

Blowers of inflammable air are more frequent in this district than in any other that I have seen. They chiefly emanate from faults or fissures of the strata in the neighbourhood of dykes, although frequently from the coal itrelf. They are most common in the opening out of newly explored seams, and are rarely met with in collieries which have been extensively laid open. In some cases, the discharge is similar to that from the safety valve of a steam boiler, and have frequently been attended with fatal consequences, by suddenly contaminating the main current of air.

Borings.—The general disposition of the coal seams in this district are given in the synopsis, page 5; but the following examples may serve to shew the results of trials in the southern margin of the coal field, now attracting much attention.

At Owton, near Hartlepool, a boring was made to the depth of 87 fathoms, which has not yet pierced the limestone. The strata consist of 120 alternations of shale and reddish sandstone, with one of thin coal towards the bottom; the boring leads to the belief that these strata are similar to the new red sandstone known to occur at Seaton Carew, on the bed of the Tees, and at Croft; therefore, if the coal exists, it must necessarily lie very deep, as the whole of the limestone strata must be passed through, and may probably be 80 or 100 fathoms in thickness.

At Hartbushes, near Trimdon, the miners have sunk through

	Fath.
Alluvial matter and magnesian limestone	100
Ordinary coal strata - - -	14
	114

They have found a seam 5 feet in thickness, but much mixed with bands of shale, and which seam is not recognisable as one of the seams of the district. They have also bored 80 fathoms lower, and have not met with any workable coal.

In the neighbourhood of Aycliffe, a boring was made, to the depth of 129 faths., without finding any coal, the lower 4 faths. being hard grit or limestone, leading to the notion that the seams all terminate before reaching that point. The apprehension that prevails with regard to this part of the coal field. as before remarked, consists in the rising of the coal strata, and the counter dipping and thickening of that of the magnesian limestone, by which means it is supposed that the coal beds may be cut off.

Salt Water.

Salt water is a phenomenon peculiar to this district, the origin of which remains as yet a perfect mystery. Throughout the whole of the deep collieries to the eastward of the meridian of Newcastle, the water below a certain depth is uniformly salt. At Birtley colliery, near Chester-le-Street, so large a feeder flows from the fissure of one of the dykes, that extensive saltworks have been for many years in operation. It was discovered in the year 1794, and then produced 1100 gallons per hour, which supply is as yet very little reduced. It is of a high temperature, and holds nearly three times the quantity of common salt contained in sea water.

Salt-works have also been erected at Lambton colliery, five miles further south; and at Walker colliery, below Newcastle, where extensive works have been for many years established in the manufacture of soda, alkali, &c.

At Butterby, two miles south of the city of Durham, an extraordinary salt spring exists, an account of which was communicated to the Philosophical Transactions, by Mr. Hugh Todd, so far back as the year 1684, who says, "The salt spring lyes at a place called Saltwater Haugh, near Butterby, and rises in the middle of the river Weare." These salt and sulphureous springs arise from fissures of the whin dyke, which, at this point, crosses the river.

My scientific friend, Dr. Reid Clanny, in the year 1807, published a little tract, upon the nature of these springs, from which work I annex the following analysis of the sulphur water; but the salt spring was so situate that an analysis could not be accomplished. I also annex the analysis of Walker and Birtley:—

Butterby Sulphureous Spring. Grains.		Walker, flowing from the depth of 55 fathoms. 1,000 grains.		Birtley, depth. 60 fs. 1,000 gr.	St. Lawrence, depth 90 fathoms. One gallon.	
Muriate of soda	56·5	Muriate of soda,	32	87	Sulphate of lime	44·88
Mur. Lime	5	Do. of lime	10	43	Choride of Calcium	854·08
Mur. magnesia	4·5	Muriate of magnesia, carbonate of lime, do. of iron, silica	1	1	Do. of magnesia	193·92
Carbonate of lime	8·5				Sulph. of iron	7·28
Sulphate of lime	3·5				Common salt	2938·24
	78·0					4038·40
Gaseous Contents.			43	141	Water	78336
Carb. acid gas	8					
Nitrog. gas	3					
Sulph. hydro. gas	11·5					82374·40
	22·5					

As I hinted, the origin of these waters remains a mystery, inasmuch as no trace of salt rock has ever been discovered in any of the deep sinkings, or numerous minings in the district.

Description of Leases.

The general mode of letting collieries throughout the whole of the district is, by the ten of 440 bolls = 18⅓ chaldrons, of 53 cwt. each ; a certain annual rent being payable, half-yearly, on account, calculated at about ⅔ the expected yearly tonnage amount. The rate of royalty, thus reserved, varies from ⅛ to 1-20th of the net value raised, according to the capital embarked and other circumstances. It does not necessarily occur that the most valuable collieries are let at the highest rates, by reason of the enormous capital required to establish some of them.

As the lessees are made to pay half-yearly a proportionate certain rent, so are they allowed to make up for such advance out of the workings of succeeding years (this is called making up shorts) ; but it often happens that unforeseen difficulties so hamper the lessees, that the shorts are never made up, and in such cases the landlord both saves his mine, and pockets the adventurer's money.

To guard against casualties, power is reserved by lessees to vacate the colliery, by giving 12 months' notice ; but they are bound to leave it in an open and tenantable state. They are also liable to all damage done to the surface in the course of working.

Coal Fields of Scotland.

In the month of November, 1834, I presented a paper upon this interesting subject to the Highland Society, for which they were pleased to award me their silver medal. This paper contained general remarks upon the principal coal fields which I had professionally visited, sections of the different seams, and their depths, as also the accompanying strata of ironstone, limestone, &c. This paper is too extensive to be transcribed here, but will be found in the Transactions of the above-named society. A few of the leading facts, however, may not be uninteresting to the reader.

The varieties of coal which occur are the splint coal, remarkably hard, grey in colour, and longitudinal in fracture. It is free from sulphur, and when burnt, leaves very little residuum, and stands unrivalled as a steam-boat coal.

Anthracite coal is found only in the Kilmarnock district. Its specific gravity is 1·6.

Parrot coal is found in various parts of Scotland, especially in the neighbourhood of Dalkeith, the Glasgow district, at Lismahago, in the county of Lanark, where it is of an extraordinary thickness and quality, and also at Balgregy, in Fife.

The Parrot coal field of Balgregy, in the county of Fife, where I established a colliery for the Messrs. Aytoun, is remarkably rich. At 32 fathoms in depth the section was as follows:—

	Ft.	In.
Coarse cherry coal	0	11
Parrot, fine -	1	6
Band - -	0	2
Fine Parrot -	3	6
	6	1

The specific gravity and quantity of gas of this coal, as compared with others, is shewn by the following analysis:—

	Sp. Gravity.	Gases.
Balgregy - -	1·22	·611
Mar. of Lothian's -	1·22	·563
Newcastle gas coal -	1·25	·400
Air - - -	1·	1·

The value of this coal, in 1837, was 16s. 8d. per ton, at the pit top; and it was sold at Kirkaldy, on ship board, for 21s. —But these high prices induced the searching for Parrot coal, which very soon afterwards produced a glut. It is used exclusively for gas works.

This bed of coal lies at an angle of 35 deg., and is situated close to the basaltic formation, and is generally in connection with the common bituminous coal.

Whin dykes, too, are frequent. That at Preston Grange colliery, near Preston Pans, is 20 yards broad, and is traceable for many miles. The Blind coal district of Kilmarnock is intersected with several dykes, of minor degree.

Mid-Lothian Coal Field.

One of the most singular of the coal fields in Scotland, is that of Mid-Lothian; containing the Edge seams, 24 in number, constituting no less than 94 feet of coal, as follow:—

Mid-Lothian Edge coal field—North-east Divison:—

	Fathoms asunder.	Thickness. Ft.	In.
1. Gramachorne or Diamond coal		5	10
2. Do. to Salter's coal - -	48	4	10
3. Do. to 9 feet coal - -	8½	5	0
4. Do. to 15 feet coal - -	5	7	0
5. Do. to 4 feet coal - -	13½	3	0
6. Do. to 7 feet coal - -	7½	5	4
Middle Division—			
1. To South Parrott - -	300	2	4
2. Do. to Wood coal - - -	29	2	7
3. Do. to Flake's coal - -	13	3	0
4. Do. to Rumble coal - -	13	2	9
5. Do. to Laverock coal - -	1	2	0
6. Do. to Great Seam - -	6	6	8
7. Do. to Stair Head Seam -	8	4	2
8. Do. to Great Gilhespie - -	11	3	10
Carried forward	463½	58	4

	Fathoms asunder.	Thickness. Ft.	In.
Brought forward	463½	58	4

North-west Division—

	Fathoms asunder.	Ft.	In.
1. Great Gillespie to Little Gillespie	30	2	7
2. Further to Corby Craig -	6	5	0
3. Do. Stenkie coal - - -	12½	2	10
4. Do. to Little splint - -	4	3	0
5. Do. to Peacock tail - -	10½	4	3
6. Do. to Real corby - -	14½	4	6
7. Do. to Carlton - - -	59	4	10
8. Do. to Blue coal - - -	8	2	6
9. Do. to Diamond coal - -	59	2	7
10. Do. to North Green seam -	57	4	3
	724	94	8

40 fathoms underneath this seam, lies the encrinal limestone of Burdie House, Gilmerton, &c.

The common bituminous coal prevails in great variety in this district, amongst which, the Jewel coal ranks highest as a house coal; it is a hard pure splint, and leaves very little residuum.

Edmonstone colliery is situate at the bottom of the basin, near the river Esk; the coals lie nearly flat, and are as follow:—

	Faths.		Ft.	In.
At	36	Splint coal	4	6
Further	7	Rough coal	5	3
	7	Beefy coal	4	0
	14	Diamond coal	4	2
	5	Jewel coal	4	0

Parrot seam of the Marquis of Lothian—

Bituminous coal -	1	9
Parrot, fine, -	0	10
Bituminous - -	0	3
Feet	2	10

The seams crop out southward, beyond Vogrie; and northward the crop is in the neighbourhood of Gilmerton, Portobello, &c., where the most eastern of the seams are vertical, and the lower seams radiate, till the North Green or lowest seam inclines at an angle of 30 degrees with the horizon. It was here that the system originated of employing women to carry coals upon their backs out of the mines, and which was in full practice at the time that Lord Ashley's bill took effect for their exclusion. To such an extent was this custom carried, that the neighbouring flat colliery of Edmonstone used to employ 140 or 150 bearers, even where the pits were 70 fathoms deep, and the coal nearly flat. The mode of descending the said pits being by a single chain, made of half-inch iron, which often broke, and the working of which was most appalling to witness, or to trust life upon. The bearing system was common throughout the east of Scotland; but females have not been employed underground in the Glasgow district, for many years. The ordinary load for one of these females, was 230lbs., carried in a coarse basket placed upon their backs, and with a strap round the forehead; the younger boys and girls commencing with a single large piece of coal, fastened in a similar manner.

The Scotsman paper, of Jan. 9, 1828, upon the subject of the *Mid Lothian coal field*, observes, that in the

Alloa coal field there are	24 workable beds.	
Newcastle do. -	40	= 32 feet.
South Yorkshire -	30	
Manchester -	50	
South Wales -	23	= 95 feet.
Liege in the Netherlands	80	
Johnson coal, near Paisley		100 do.
Lothian coal field	31	109 feet.

The Lothian basin the editor states to be in length 25 miles, by 6 miles, its greatest breadth; equal to 80 square miles. The whole resting upon grey limestone; notwithstanding which coal is said to lie below the limestone, but not of any value.

There is no reason to doubt that there is a continuation of this coal field over Fife, and which is supposed to constitute the district at Dysart and Kirkaldy.

The editor concludes, with a calculation of the duration of the Edinburgh coal field, thus, "after making every allowance, taking it at 60 feet thick, and 80 square miles, the specific gravity 1·329; and 500,000 tons, as the yearly consumption, it gives a duration of 7,200 years, independent of any supplies from Fife, West Lothian, &c."

The Clackmanan district may be called the North west boundary of the Scotch coal field; it is bounded on the north by the Ochill transition mountains, beyond which no coal has ever been discovered; and on the south by the Frith of Forth, which divides the county from Stirlingshire; it is continuous eastwards through the county of Fife to St. Andrews.

There is nothing very remarkable in the Clackmanan coal field, except the numerous beds of coal, the abundance of ironstone, and the existence of two grand slip dykes, which, according to Mr. Bald, (many years manager of Alloa colliery,) divide the coal basin into three separate fields, the southern of these dykes is a downthrow to the south of 1,230 feet, and the northern dyke is also a downthrow to the south of 700 feet.

The following table shews the coal beds in each field:—

North Field.					Middle Field.					South Field.				
	Yds.		Ft.	In.		Yds.		Ft.	In.				Ft.	In.
At	22	coal	3	0	At	26	coal	3	0	At surface		coal	6	0
Fur.	18	do.	2	6	Do.	18	do.	2	6	Further	23	do.	2	6
Do.	12	do.	3	0	Do.	12	do.	3	0	Do.	7	do.	5	0
Do.	32	do.	3	0	Do.	32	do.	3	0	Do.	53	do.	9	0
Do.	9	do.	5	0	Do.	9	do.	5	0	Do.	20	do.	2	6
Do.	9	do.	4	0	Do.	9	do.	5	0	Do.	66	do.	3	0
Do.	22	do.	9	0	Do.	22	do.	9	0	Do.	14	do.	3	6
Do.	66	do.	3	0	Do.	86	do.	3	0	Do.	10	do.	2	8
Do.	10	do.	5	6	Do.	11	do.	5	0					
Do.	10	do.	3	6	Do.	11	do.	3	6					
Do.	28	do.	4	6										
Total	238		46	0		236		41	0		193		34	2

The number of alternating strata is 141, and the section exhibits 24 seams of coal, from 2 feet to 9 feet in thickness, amounting in all to 59 feet 4 inches, all of the open burning kind.

The Dunfermline district is celebrated for splint coal, valuable for steam purposes, as beforementioned. It is a pure coal, and carries its size better than almost any other; it is worked extensively, in the collieries of Admiral Sir P. Durham, Lord Elgin, at Halbeath and Wellwood, and is generally about 3ft. 9in. thick.

The Kilmarnock district is famous for the production of blind coal, or anthracite. One peculiarity regarding this seam deserves to be mentioned. The first three seams of the above section, at Caprington colliery, which I also established for Mr. Cunningham, are of the common bituminous coal; and the fourth seam is of excellent blind coal, spec. gravity 1·6, and immediately beneath the coal lies a whin sill, or basaltic formation, which is understood to have been the means of converting the coal into anthracite, from its formerly heated state. This opinion is corroborated by the fact, that in proportion as the whin sill lies more near or more distant from the bed of coal, it is more or less of this nature; and in certain margins of this coal field, in which the coal and the whin become considerably apart, this coal becomes again ordinarily bituminous.

Kilmarnock Section—

	Faths.		Ft.	In.
At	5	Three quarter coal -	2	3
Further	10	Seven ditto - -	5	0
Do.	9	Ell coal - - -	3	2

(These seams are of the ordinary bituminous coal.)

	Faths.		Ft.	In.
Do.	12	Blind coal - -	3	2

Excellent anthracite 1·5 spec. gr.

The southern outcrop of this coal field, upon the Caprington Castle estate, rests upon blue limestone, the following of which is a section.

	Ft.	In.
Broken stone and rubbish - -	8	0
Coarse freestone - - - -	20	0
Rubble slate - - - -	0	8
Carried forward - -	28	8

	Ft.	In.
Brought forward	28	8
Ironstone	0	6
Raffstone	4	0
Blue limestone, good for building	1	0
Black slate	2	6
Bastard ironstone	0	4
Limestone, good for land	9	0
	46	0

Below which, is marle.

Ayrshire Coal Field.

In the Mansfield colliery, at the head of the Nith, in Ayrshire, we find a remarkable coal formation cropping out, viz. :—

	Ft.	In.
A seam of various qualities of coal, and good	9	0
Sandstone	6	0
Another seam of various qualities, part cannel	12	0
	27	0

And a short distance from this place, upon the Muir,

	Feet.
Is Peat-moss	10
Clay	6
Coal of various mixtures and qualities	30 good.

Underneath this strata, and at a short distance, the mountain limestone is worked, and is as follows, viz. :—

	Ft.	in.		Ft.	in.
Earth	1	0	Blaes roadstone	2	6
Freestone	4	0	Good limestone	5	0
Fire clay	5	0	Soft blaes	3	0
Alum shale	1	6	Coal	1	9
Good blue limestone	4	6			
				28	3

Glasgow Coal Field.

The district round Airdrie may be taken as a specimen of the Glasgow seams, viz.:—

	Faths.		Ft.	In.	
At	14	Pyat Shaw coal	3	6	Often united and form a seam 8 or 9 ft. thick.
Further	1	Main coal -	3	0	
Do.	13	Splint coal -	3	4	
Do.	1½	Sour milk coal	2	0	
	29½				
Do.	12	The famous black band ironstone.			

Ironstone section in the neighbourhood—

	Ft.	In.	
Cannel coal - - -	4	0	
Slate and ironstone balls -	1	0	
Black band, same - -	1	2	as at Calder.
Free coal - - - - -	0	8	
	6	10	

Quarrelton, in the county of Renfrew, belonging to Mr. Johnstone, of Houston, is perhaps the most singular mass of coal in the world, the whole extent from north to south being about a mile, and from east to west ¾; to the north it crops out near the surface, and to the south it is cut off by a whin rock. It is every where covered by a hard blue whinstone, containing nodules of limestone; and the general section of strata is as follows:—

	Feet.
Hard blue whinstone -	100
Sandstone and aluminous shale	24
Soft fire clay till - -	12
Coal, 50 to - - -	60
	196

This coal is composed of five distinct seams, separated from each other by ironstone bands, 9 or 10 inches thick. Underneath, the coal again interposes whinstone; it is in this field that a double series of beds seems to overlap each other, sometimes with sandstone between them.

Ironstone.

In no part of Britain does ironstone more abound than in Scotland, the famous black band which is held in such high estimation in the Airdrie district standing pre-eminent; its average thickness is about 20 inches, accompanied more or less with coal, which cheapens the cost of working it. It has the appearance of rusty black shale, and when laid together in large heaps, it is so combustible that it ignites, leaving a calx containing about 60 per cent. of iron. For a long time, it was thought to be confined to the district of Airdrie, but it is now found to accompany the coal throughout vast extents of the neighbouring counties, and may be termed inexhaustible; the market price calcined is 8s. or 10s. per ton. Common ironstone is also very abundant in connection with the coal, and, in former times, formed the principal supply which induced the foundation of the Carron iron-works, in the neighbourhood of Falkirk.

Mode of letting Mines in Scotland.

The general custom of Scotland provides for yielding to the landlord a royalty proportioned upon the net amount of sales at the colliery, in conjunction with a certain or sleeping rent, payable half yearly.

This royalty proportion is sometimes so high as ¼ the amount of sales, but, generally speaking, ⅛; of late years, many collieries have been let at 1-12th, and even so far as 1-14th the amount sales.

The law of fixtures being somewhat different in Scotland to that of England, some important points have arisen in late years touching buildings, the tubbings in pits, &c.; also, the responsibility of landlords, in case of damage being done to property, by the working away of coal wherein the landlord has concurred and received his rent. Such was the case at Bartinholme colliery, in Ayrshire, in which the Earl of Eglington,

the landlord, was made joint defendant with his lessees, in consequence of the colliery being drowned up by the breaking in of the river Garnock, even two years after all working had ceased, and the colliery abandoned.

Collieries in Yorkshire.

Newton colliery, near Leeds—

	Yds.		Ft.	In.
At	12	stone coal	3	3
Fur.	12	black band	3	9
	25	brown nib	2	3
	25	Harg Moor seam	3	9
	74			
Do.	26	seam	4	9

The district around Sheffield contains a very fine series of seams, which, according to Mr. Farey, "amounts to no less than 12 beds of workable coal," which the same author, (who wrote in 1811,) said "had been more or less worked in by 500 collieries." The principal seams of coal worked for the supply of Sheffield and its vicinity, are six in number, lying between "The Rotheram red rock," and the Wortley sandstone. The section as follows:—

	Ft.	In.
Tinsley Park seam	4	0
Further 13 fathoms furnace coal	2	3
Do. 20 High Hazzles	3	9
Do. 50 Handsworth seam, the lower part of which is Cannel coal	4	6
Do. 100 Manor seam	5	0
Do. 55 Sheffield bed, top part Cannel	6	0

The coal measures dip rapidly towards the east.

Victoria colliery, near Wakefield—

			Ft.	In.
At	60	yards shale coal	1	6
Fur.	18	Stanley mine	5	7
Do.	102	Haig Moor seam	3	0
	180			

A new winning of this, the deepest colliery in Yorkshire, has lately been effected, to the depth of 290 yards, and the shaft fitted up with slides and tubs, according to the recent improvements of the Newcastle district. Other pits are fitted up with endless chains.

These same seams are wrought pretty extensively, by Messrs. Charlesworth, Smithson, and others in the neighbourhood, and around Wakefield; the Haig Moor being the standard seam.

Near Bradford, only two workable seams are known, viz.:—

	Ft.	In.
First coal black bed - -	2	9
Further 40 yards bottom bed -	2	2

These coals are of prime quality for making coke, and the strata abound in layers of excellent ironstone, forming the staple supply of the Low Moor ironworks.

The Lancashire Coal Field.

The limit of this extensive coal field is not yet defined, nor can the immense number and variety of the different coal beds be specified. The extent assigned to the coal field, by the intelligent author of Fossil Fuel was 500 square miles, already explored. But I am of opinion, that a great district of country to the westward of Prescott, remains as yet unproved, and which will be found to contain coal.

The ordinary bituminous coal prevails over the whole district, but the neighbourhood around Wigan seems to possess the most valuable descriptions in the Cannel and the Orrell coal; the former remarkable for its production of gas, and the latter for house purposes, being of a quality very similar, and little inferior to the Newcastle coal. As a proof of the estimation in which the Orrell coal is held, a property of 30 statute acres in that neighbourhood, consisting of 9 feet of coal in three seams, was sold in the year 1825, for the enormous sum of £24,000.

Although the best of the Lancashire coal bears a strong resemblance to the best Newcastle coal, yet whether from its nature, or the mode of working, it does not appear to be so hard, nor are the cokes at all to be compared in density with those made from the best coals of the Newcastle district.

The Cannel coal of this field is of a peculiar formation: it is often closely connected with, and often far apart from, the King coal beneath. Its fracture is smooth, jet like, abounds with gas, and takes a fine polish; in short, it is like no other coal, nor do I believe that the like of it is found in any other coal field in Britain; its name designates its property, as it gives a splendid light. Generally speaking, the Lancashire coal field, abounding as it does with such a numerous succession of seams, presents very few of the mining difficulties which attach to the Newcastle district. The sinkings are moderately deep, the quantity of water inconsiderable, the seams lying at convenient angles, and of eligible thickness for economic working, as will appear from the following synopsis of some of the districts.

The Pendleton colliery, near Manchester, lately drowned, was, I believe, the deepest colliery in the county, and the seams in it were according to the following section, viz.:—

Pendleton, near Manchester.

	Yds.		Ft.	In.
At	120	Four feet seam	4	0
Fur.	287	Bing coal	3	6
Do.	60	Seven feet seam	5	0
Do.	40	New 6 feet do.	6	0
	507	Total	18	6

Evans' Colliery, near Sutton.

	Yds.		Ft.	In.
At	31	Yard coal		
Fur.	10	do.	3	0
Do.	24	Potatoe delf	4	0
Do.	23	Earthy delf	4	4
Do.	16	Three-qr. coal	2	6
Do.	78	Higher delf	4	0
Do.	13	Lower delf	6	0
	195	Total	23	10

Poyndon and Worth, near Stockport.

	Yds.		Ft.	In.
At	111	Four feet seam	4	0
Fur.	40	Five do.	5	0
Do.	40	Three do.	3	6
Do.	45	Reform mine	3	6
	236	Total	16	0

Douglas Bank, near Wigan.

	Yds.		Ft.	In.
At	22	Riding mine	3	0
Fur.	22	Little delf	2	3
Do.	6	Yard coal	3	3
Do.	18	Four feet coal	3	9
Do.	9	Seven feet coal	6	0
	77	Total	18	3

Great Lever Colliery, near Bolton.

	Yds.		Ft.	In.
At	50	Three feet mine	4	6
Fur.	30	Six do.	6	0
Do.	70	Yard mine	3	0
Do.	30	Nine feet do.	8	0
	180	Total	21	6

Ashton Green Colliery Eccles and Stock.

At	108	Six feet mine	5	0
Fur.	39	Nine feet seam	9	0
	147	Total	14	0

Sankey Brook, near St. Helens.[*]

	Yds.		Ft.	In.
At	145	Higher delf	4	6
Fur.	5	Main delf	9	4
Do.	20	Bastion mine	4	6
Do.	13	Roger mine	6	0
Do.	60	Sir John do.	3	0
Do.	16	Flaggy delf	4	2
Do.	20	Roger delf		
Do.	130	Rushy park	4	6
Do.	50	Little delf	3	0
	459	Total	39	0

Arley Colliery, Lord Balcarras, near Wigan.

	Yds.		Ft.	In.
At	12	Yard coal	3	0
Fur.	60	Bone coal	2	0
Do.	28	Smith coal	2	3
Do.	60	Arley mine	5	0
	160	Total	12	3

Halsnead Colliery, near Huyton.

	Yds.		Ft.	In.
At	53	Fellcroft seam	8	6
Fur.	22	Pasture seam	5	9
Do.	24	Yard mine	3	4
Do.	12	Kennell mine	5	9
Do.	21	Higher bug seam	6	9
Do.	1¼	Lower do.	3	6
	133¼	Engine pit		
Do.	23	Little end	2	3
	156	Total	35	10

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[*] These seams are known to lie underneath the seams of Ashton green colliery.

The Halsnead seams crop out towards Prescot, and are brought in contact with the new red sandstone, to the south-eastward of this colliery by an upcast fault, beyond which the coal has not been proved.

I am not aware that the Lancashire coal field is thoroughly explored, especially in the western division. The collieries of Halsnead, Huyton, and Prescot are the furthest advanced in that direction, and which are approaching the new red sandstone, beyond which the country has been very little explored by boring. An opinion seems to prevail, that the red sandstone, which extends from this neighbourhood to Liverpool, and across Cheshire, is indicative of a deficiency of coal; but it does not appear that any trials have been made to such an extent as to ascertain the fact; and it is a matter of curious speculation, as to whether there be any well grounded assurance against coal existing underneath the Liverpool red sandstone. I confess it does not appear to me that there is; and I think that deep borings will hereafter prove a continuation between the Lancashire and the North Wales seams.

Cumberland Coal Field.

The Cumberland coal field stretches along, and is bounded by the Irish Sea, and is continuous from St. Bees head, to the neighbourhood of Allonby. To the eastward, it crops out against the blue limestone and the transition mountains, in the range of Lamplugh and Cockermouth, and it extends south-eastward in a narrow strip of 3 or 4 miles in width, by Plumbland, All Hallows, Bolton, and Rosley Hill.

The two great collieries of Whitehaven and Workington are prosecuted for many hundred yards underneath the Irish Sea, where the coal has a rise to the south west, of one in 3 or 4. This coal field is also intersected with dykes of considerable magnitude. The great dyke which divides Whitehaven colliery into the divisions of Whingill and Howgill, is a downthrow to the north, of 55 yards; and there are dykes of larger import than this in the Workington colliery. The extent of coal under the Irish Sea, in this district is, of course, incalculable, and can only be attained by underground operations.

An extensive winning is now in progress at Whitehaven, intended to be the deepest sinking, and most extensive drifting in the kingdom, in order to prosecute the working of this ocean coal.

The conveyance of coals along the intended horizontal stone drift is to be accomplished by engine power, either stationary, or locomotive; and the seams to be won are, the main band 10 feet, and the Bannock band 7 feet thick.

The same seams prevail at Workington, but since the catastrophe in 1837, all working under the sea has ceased, and it can only be restored by an exceedingly deep sinking, and most extensive drifting.

A curious instance of the nipping out of this main band seam occurred at the Isabella pit, which was sunk at enormous cost by the late Mr. Curwen, to the depth of 130 fathoms. —All the accompanying circumstances concurred in leading the miners to conclude, that they would attain the main band seam; but at that position no other trace of it was visible, than a seam a very few inches thick. A drifting, however, in this thin seam was carried out for several hundred yards, where, at a slip dyke, the seam was found in its natural thickness, but it proved without doubt that for a very considerable extent, and underneath the river Derwent, the seam is wanting, although no change has taken place in the upper beds of coal. To the westward of the Isabella pit a dyke occurs, at which the coal is thrown down 40 fathoms.

The new red sandstone which overlies the coal strata, makes its appearance in the neighbourhood of St. Bees, and was, until lately, (like our magnesian limestone) the subject of much controversy, whether any good coal were to be found underneath it; but these doubts are long since dispelled, and it is now beyond question, that the coal is totally uninfluenced by the said sandstone.

As the Workington seams progress upon the main rise south-west towards Harrington, they successively crop out, and the lower seams form the subject of extensive workings at Harrington colliery.

Seams in the Isabella pit, Workington colliery—

	Faths.		Ft.	In.
At	83	Metal band	3	0
Fur.	27	Moorbanks seam	3	6
Do.	24	Little main band	3	2
Do.	16	Main band	10	0
	5	———		
	135	Total	19	8

Harrington colliery in the lower seams, which underlie the Workington coals:—

	Faths.		Ft.	In.
At	20	Metal band seam	1	8
Fur.	15	Two feet coal	1	10
Fur.	17	Three feet ditto	2	8
Fur.	38	Four feet seam	3	4
Fur.	28	Five feet or Udale seam	4	0
	118	Total	13	6

Since the completion of the Maryport railway, great quantities of coal have been opened in that neighbourhood for exportation, and now form a powerful competition with Whitehaven, and the rest of the western coast.

A remarkable formation of iron ore or stalactite prevails to the eastward of Whitehaven, which is understood to contain 60 per cent. of iron; it is worked extensively, and shipped to South Wales.

A peculiar seam of coal is worked in the neighbourhood of Sebergham, near Heskett, in this county. Its fracture assumes a diamond form; and it partakes partly of the nature of Parrot, caking coal, and anthracite, and is of rare quality. The basin is very small, and apparently unconnected with any of the neighbouring coal fields, the seam is nearly 3 feet in thickness, 22 fathoms in depth from the surface, and the water is pumped by means of a water-wheel, worked by the neighbouring rivulet. In the neighbourhood of Maryport, one of the thick seams is composed of a junction of the Cannel and metal band, from the thinning of the strata between them.

The mode of letting leases in this district, is precisely the same as that of Newcastle.

Mode of letting Collieries in Yorkshire and Lancashire.

The seams of coal being specified, a certain annual rent is agreed to per foot thick per acre; and the tenant agrees to work away, or pay for an agreed number of acres per annum.

At the end of each year, a plan and admeasurement is made of the quantity so taken, in order to ascertain the rent; each year's workings being coloured differently. The amount of rent so provided for, differs so widely according to the peculiar circumstances of the collieries, that scarcely any general statement can be made upon the subject. Suffice it to say, that it ranges from £50 to £100 per acre per annum; and taking a 3 feet seam (at a ton per cubic yard) to contain 4840 tons, three-quarters of which are producible = 3630 tons, and the said tons to be sold at 5s. each, it will amount to £907, in which case £100 would amount to one-ninth, or about 6½d. per ton.

Notwithstanding this is the general principle of letting over a great part of the midland district, it is by no means so clear and practicable as by the ton, or by the amount sales, because the preparatory workings of a colliery are in no shape to be measured; and calculation so to be made, not at all in unison with the irregular form of many of the preparatory stages of working. Indeed, so simple and preferable is the renting by tonnage, that it is superseding the old custom rapidly.

North Wales.

The most important and extensive colliery in this district is situated at Mostyn, the property of the Hon. Edward Lloyd Mostyn.

The ancient working of this coal, described by Mr. Pennant, in his history of North Wales, was commenced within the present park, in which the several seams were seen cropping out at the surface, and where many pits have been sunk, and which were minutely described by the late Mr. Farey, mineral surveyor, in plans and reports now in the family.

In the early working of the colliery the coals were conveyed away by small vessels, which at that time approached Mostyn quay at high water; but the bed of the river Dee having afterwards changed towards the northward, a partial canal, or excavation was cut for the passage of vessels, which was defended by stakes and furze.

Of late years, this approach has been enlarged and improved, which, together with convenient docks, enables vessels of 300 tons to load at the colliery, carrying away 50 or 60,000 tons of coals, per annum.

When the rise coal was exhausted, a portion of the river Dee was enclosed, by mounds, or dykes, within which the present deep sinking was executed to the Durbog seam, a depth of 150 yards, by Messrs. Eytons, the present lessees.

Extensive workings have afterwards been carried on under the river; and upon more occasions than one, both in ancient and modern times, incautious working has led to breaches, through which the river has entered the colliery.

The various seams are commanded from the main shafts by horizontal stone mines, driven from seam to seam; and as this is repeated in very many instances, it renders the colliery workings both complicated and interesting. The men and horses go in and out of the colliery at the outcrop of the five yard seam. Some very remarkable but providential downthrow faults prevail in this coal field, inasmuch as they only counteract the otherwise inconvenient effects of the excessive inclinations of the coal beds. Nearly one half of this coal is left in pillars, to guard against the waters of the Dee. The main dip of this field points towards Park Gate, on the Cheshire side of the river; and as the strata there have a counter rise, it leaves no room for doubt that they are a continuation of the same extensive basin.

The southern explorations of this colliery are pushed to within a short distance of the Halken mountain, of limestone formation; therefore, an actual termination is seen to the coal field in that direction, as corroborated by some experimental borings downwards.

From hence eastward up the shore of the Dee, viz. at Greenfield, Baghilt, Flint, Hawarden, &c., various coal minings are carried on; but much of the district is "troubled," and consequently great difficulty is experienced in reconciling and comparing the several seams with those at Mostyn. The Baghilt collieries are very ancient, and are worked considerably underneath the river Dee, by means of engine power, as the coal inclines deeply in that direction; but they were all brought to a stand-still in July, 1842, by the colliery of Messrs. Eytons coming in contact with the Old Boot colliery, many years previously filled with water, which naturally flowed down the dip workings of the neighbouring colliery, leased to Messrs. Pickering & Co., and between which the workings were in common; the result was, the entire drowning up of both collieries.

In consequence of this, the landlord, Sir John Hanmer, brought an action, and laid damages at £100,000. The cause was tried at Chester, August, 1843, and a verdict was given respectively, the sums of £1,613, or £6,240, dependent upon some points, specially reserved. A new trial has been called, and thus the matter rests.

The irruption of this water was extremely sudden, and had it not happened on a Sunday evening, when no one was underground, in all probability several lives would have been lost. It nevertheless forms another argument, for the application of some principle of inspectorship, as a court of appeal relative to questions of this description.

At Hawarden, the entire dip is to the northward, and the presumed outcrop ought to take place on the Cheshire side of the river; but, owing to the remarkable extent of flat land, and the depth of alluvial matter, no discovery of coal can take place, except by borings; though there is every reason to believe that, hereafter, this part of the county of Chester will be the seat of extensive coal minings, unless the coal should lie at an extraordinary depth.

A very considerable quantity of ironstone accompanies this coal field, both at Mostyn and upon the south-eastern division beyond Mold, where at Coadtalon, and the neighbourhood, extensive ironworks have been established.

Sections in North Wales.

Near Flint—Dee Green.

Faths.		Ft.	In.
At 30	Two yard coal	6	0
Fur. 10	Five yard ditto	5	0
Fur. 15	Four feet ditto	3	6
—			
55			
12	Lower 4 feet do.	3	10
—		—	—
67		18	4

Coad Talon Iron Works.

Yds.		Ft.	In.
At 63	Powell coal -	2	0
3	Two yards coal	5	0
33	Brassy coal -	4	6
37	Main coal -	10	6
—		—	—
136		22	0

Mold Town Colliery.

Faths.		Ft.	In.
7	Holland coal	6	0
Fur. 7½	Brassy coal	3	0
Fur. 12½	Main coal -	3	6
—		—	—
27		12	6

Mostyn.

	Ft.	In.
Cannel coal - -	4	6
5 yard coal - -	15	0
3 yard coal - -	9	6
2 yard coal - -	6	0
Durbog - - -	5	0
	—	—
	39	0

The coal field is continued southward, in narrow basins, till it terminates at Llangollen, by cropping out against the mountain limestone.

No other coal field has been discovered to the southward of this, in North Wales; indeed, the whole country through Bala, Dolgelly, Barmouth, Towey, &c., presents no strata belonging to the coal formation; and, however desirable coal may be in those parts of the country, there is no reason to believe that trials would be repaid with any hope of success.

To the westward of Mostyn colliery, along the shore of the Dee, and towards the scene of the famous Talacre speculations, there seems no reasonable hope that coal of any value exists, inasmuch as the Mostyn seams are known to crop out, and terminate very contiguous to the colliery; and but for the interposition of some important downthrow dyke, it cannot be; although the coal strata seems to extend pretty widely, and lie very regularly along the coast.

South Staffordshire.

This county is chiefly remarkable for the ten-yard coal which generally prevails, as well as the numerous beds of ironstone contained in the shale, accompanying the coal beds.

Divisions of the ten-yard coal.

	Ft.	In.
Rooves - - - - -	4	0
White coal and top slipper	5	0
Tow coal - - - -	3	0
Foot coal and Brazils -	3	0
John coal - - -	1	6
Veins - - - - -	3	0
Stone coal - - -	4	0
Sawyer - - - - -	4	0
Benches - - - - -	2	6
	30	0

I am indebted to Mr. Brook Smith, of Walsall, for the following account of the different seams in the two divisions of West Broomwich and Wolverhampton, viz.:—

West Broomwich—

	Yds.		Ft.	In.
At	139	Brooch coal -	3	0
Fur.	53	Ten-yard coal -	31	0
Do.	5	Heather coal -	3	4
Do.	17	New mine coal -	6	4
	214		43	8

Wolverhampton—

Yds.		Ft.	In.
At 16	Outcrop of ten-yard coal	30	0
Fur. 9½	Heathen coal	2	3
4½	Rubble coal	2	4
14	Stinking coal	3	0
22	New mine coal	6	4
9	Fire-clay coal	9	0
4	Little coal	2	0
22½	Bottom coal	9	0
15½	Singing coal	3	6
117	Total	67	5

At a level line upon the surface, the new mine coal would be about 240 yards deeper at West Broomwich than at Wolverhampton, the distance between the two sections on the surface from the ordnance map is 4¼ miles.

The seams under 5 feet thick, as well as the ironstone bands, are wrought chiefly by long wall.

The ten-yard coal is worked by places 3 yards wide, leaving pillars 6 to 8 yards square, according to the nature of the coal and roof. At about every 30 yards, a fire rib of whole coal is left 6 or 8 yards thick, to separate one set of workings from another, forming an excavation 40 yards square, with a fire rib on each side, and 4 pillars standing in the goaf, 8 yards square each. The gross contents of the 10 yard seam is about 48,000 tons per acre; whereas by the customary mode of working, what with coal left to form a roof, the fire ribs, and other losses, not more than an average of 16,000 tons is obtained.

In Cordley coppice pits, West Broomwich, there is a salt water leakage from the coal, which was very similar to the Leamington waters, both in flavour and effect. The proprietor had bottles of it sent to Dudley, and he took it as an aperient. These pits were nearly 200 yards deep, and within 12 miles of the centre of England.

Strata of ironstone—

Gubbin ironstone	3 measures,	lying in	3	feet of spoil.
New mine ironstone	3	do.	5	do.
Penny measures	- - -	do.	21	do.
Poor Robin	- - - -	do.	2½	do.
Balls and gubbin do.	- -	do.	7	do.
Blue flats do.	- - -	do.	6	do.

Castle Comer Coal Field, County of Kilkenny, Ireland.

Having frequently visited, and for some years been interested in this remarkable coal field, I am induced to transcribe a few of the most remarkable facts in respect to it.

The general circumstances and geological arrangements have been ably pourtrayed by Mr. Griffith, in his geological treatise of the Leinster coal district, in 1814, from whose report the following general description is extracted.

The coal field is surrounded by, and rests upon, the mountain limestone, said to be 500 fathoms thick, and which rests upon granite. Colour, light blue, containing numerous petrefactions of madrepores, encrinites, &c. Analysis:—

Carbonate of lime - - -	95
Silica, with tinge of iron - -	4·50
Carbon - - - - -	0·50
	100·00

The stratification of the exterior hills of the district on every side, is found to incline towards the interior of the country, the strata lying nearly parallel with the surrounding slopes, and thus forming an irregular valley, in which the coal basin is deposited.

I can corroborate Mr. Griffith's statement as to the existence of 8 beds of coal between the surface and the limestone. A remarkable black slaty rock rests upon the limstone. In many places the lower beds resemble flinty slate; but as they are further removed from the limestone, the flinty slate passes gradually into black slate clay, the upper part of which often contains nodules of ironstone. This rock varies in thickness from 30 to 300 feet; it is often so black, that in boring, it has been mistaken for coal.

Section of coal seams:—

	Faths.		Ft.	In.
At 1st.	6½	Upper three feet seam	3	0
Further 2nd.	3½	Double ditto - -	3	6
These seams are cropped out and little seen.				
3rd.	20	First three feet coal -	3	0
4th.	22	Drummagh foot coal -	1	0
5th.	23	Four feet coal - -	4	0
These are the seams wrought at Castle Comer and Newtown.				
6th.	35	Second bed slate coal -	3	0
7th.	89	First ditto ditto	4	5
8th.	40	Rossmore coal - -	0	10
	135	to the limestone.		

The alternating strata are sandstones, ironstones, slate clays, fire clays, and a peculiar sort of black or green slaty rock, partaking of the nature of basalt.

The coal field of Castle Comer may be said to be confined to the three feet coal No. 3, and the four feet seam lying 70 or 80 yards below it, the said three feet bed having formed the great subject of the colliery, and is called the Kilkenny coal. According to Kirwan, it contains 96 or 97 per cent. of carbon, and 3 or 4 per cent. of ashes, and is much purer than the carbonaceous coal of South Wales or Scotland; the specific gravity is 1·526.

The roof of this coal is of black slate clay; it extends through the lordships of Castle Comer and Clough.

The colliery was commenced at the beginning of the 17th century, by Sir C. Wandesford, and has been continued ever since; the extent of this seam being over 3,000 acres. The colliery, says Mr. Griffith, "has been worked after the most improper and expensive manner possible, having continued without the least underground improvement during the last 100 years, the pits being rarely 100 yards asunder."

"During the last 12 years, upwards of 200 pits and bore-holes have been sunk in the royalty of Castle Comer, and by the Grand Canal Company in the adjoining colliery; many thousands of pounds have been ignorantly thrown away."

"The annual raisings in the Leinster coal district at that period, were stated by Mr. Griffith at 70,000 tons hard coal, and 100,000 tons of soft coal or culm. Price of coal at pit mouth 20s. per ton, and culm 5s."

"Notwithstanding this exorbitant price, these coals were sent to Kilkenny, to Athy, and thence by canal to Dublin, and also to Tullamore, and by the river Shannon to Limerick; chiefly used for malting."

The peasants use "pounded culm, with one-fourth part of clay, worked together like mortar, and then formed by the hand into balls of about 3 inches diameter."

Mr. Griffith says, "that the four feet coal is closer in its grain and much harder, than the coal hitherto known as the Kilkenny coal; its specific gravity is 1·591." Upon analysis, it was found to be composed of 96·250 of carbon, and 3·75 per cent. of dark grey ashes. "Owing to its great depth, this coal must be worked upon some regular and scientific plan." From the different positions in which this coal had been found, Mr. Griffith concluded, "that the property would contain 5,000 acres of it." The stratification above it consists of black slate, with numerous bands of clay ironstone; and from the quantity of pyrites found in and about the coal, Mr. G. supposes that they might be turned to good account in the manufacture of copperas.

The Castle Comer coal field, then, may be said to possess an area of about 8 square miles, commencing about a mile to the eastward of Castle Comer town, and extending from Aghamuckay to Doonaan, including Clough, Massford, Crutt, &c., in the county of Kilkenny, and Newtown Rushes, &c., in Queen's County.

The third or four feet seam lies at the distance of from 35 to 40 fathoms below the said three feet coal. It was worked at it south-west outcrop at Rock, near to Castle Comer; and I also sunk to it at Boneyarrow, towards the north-east boundary, where it was 26 fathoms deep; but in both these cases it was so hard, so thin, and so sulphureous, that it could not be worked to profit.

All these seams are anthracite, the middle one excellent of its kind, and that which has for so many years formed the subject of these Castle Comer collieries.

A very particular account of this colliery is given by Mr. Tighe, in his Agricultural Survey of 1802, viz.:—

Boate in his history of Ireland, 1726, says, "*Already one coal mine has been found in Ireland, a few years since, by mere hazard, and without having been sought for, in an iron mine belonging to Mr. Chris. Wandesford; after having raised the ore from it for a great while, they came at last to coal. It was then 9d. the Irish car, 3d. to the digger, and 6d. to the owner, for 6 cwt. = 1½d. per cwt. These coals are very heavy, burn with little flame, but lie like charcoal, and continue so for the space of seven or eight hours, casting a very great and violent heat.* In the place where the mine standeth do lie little smiths' coals above the ground, from whence the smiths dwelling in the parts round about did use to come and fetch them, even before the mine was discovered." The lordship of Castle Comer consists of 13,400 acres, and was purchased by Sir C. Wandesford, during the administration of Lord Strafford.

"Lord Wandesford obtained some regulations, by act of parliament, for the better management of the collieries, and for their defence from stealth. The late Lord Wandesford used to clear £6,000 or £7,000 per annum by his collieries; the principal working was between the small river Dian, and the side of the hills to the east and north-east, extending from Castle Comer towards Donane."

The following statements will shew the results of working the colliery in the early days of its existence.

A barrel is understood to be 6½ cwt.

Quantity of coals raised and profit for 3 years, viz. :—

	Barrels of coal landed.	Colliers' money 2s. p. bar.	Value 6s. 3d. p. bar.	Value of Culm sold.	Expenses servants& contings.
		£.	£.	£.	£.
From 1st April, 1797, to 31st March, 1798	57820	5782	15527	1011	12794
From 1st April, 1798, to 31st March, 1799	57180	5718	14960	397	12929
From 1st April, 1799, to 31st March, 1800	59980	5998	16566	839	15252

Lady Ormonde, finding the expenses so great, and the profit so small, raised the price of coals, in 1800, from 6s. 3d. to 8s. 8d. a barrel; and the accounts for the first four months stood as follows. A barrel may be estimated to weigh 6 cwt.

1800	Barrels	Colliers' money. £.	Barrels sold.	Value	Culm	Expenses servants & contings.
April	4830	483	3260			
May	4000	401	3422			
June	3550	355	6041			
July	3840	384	6016	£8375	£687	£6256
Total	16220	1623	18739			

Up to this period, no other means than jack-rolls were thought of for drawing the coals; indeed, to such short distances were the pits wrought, that they were exhausted in a year or two.

The establishment and prices of agency at that time were as follows:—

2 Overseers aboveground, at - -	£50 each.
4 Underground do. - - - -	15 do.
2 Inspectors - - - - -	18 do.
2 Carpenters and 6 smiths - -	12 do.
8 or 10 Clerks at sales - - - -	18 do.
Watchmen - - - - -	12 do.

Store kept out of which were retailed—

Candles 1s. per lb.

Wheaten bread was the food of the colliers, but their earnings were generally consumed in the purchase of spirits, causing their appearance to be most wretched; their houses ruinously built, and covered with sods, upon which heavy stones were laid to prevent them being blown away. Chimneys and windows were luxuries deemed unnecessary; the children were usually quite naked, and the colliers so unhealthy, that they rarely reached the age of 50. Previous to their death they often spat up a black spittle, arising from the volatile but sulphureous dust of the anthracite coal, and from the leaning posture in which they worked.

This coal was carried to Londonderry, Cork, Waterford, Dublin, &c.

A good deal of iron ore prevails in the neighbourhood, called shell mine, or white mine, containing kernels or honey combs. In the time of Lord Strafford, this iron was manufactured, according to Boate, into "ordnance pots, small round furnaces, &c."

The iron thus manufactured with charcoal was sent down the Oure to Ross and Waterford, in boats, called cots, made of one piece of timber; and it was sold in London at from £16 to £17 10s. per ton, and produced a clear profit of from £6 to £7 per ton.

Boate says, that when the ore was rich, a ton of iron was produced by 2½ tons of raw material.

Notwithstanding the high price of this coal, the wants of the country always absorbed it. Whilst the Swansea coal cost 6s. per ton, and some of the Welch not above half that sum at the mines, the Castle Comer coal cost 18s. per ton at the pits; at the same time, its durability may be stated at half as long again as that of Swansea.

The smoke from this coal is highly sulphureous; and being heavier than common air, it is very offensive in houses if not carried properly away.

In 1800, the general charges of the concern, after paying the colliers, were as follows:—

Landing or drawing up the pits, per jack-roll	£2343
Contingencies, watchmen, agencies	2902
Engine tenders	102
Finlan, director of steam engines	56
Charities	111
Wages, roads, &c.	742
	£6256
Add colliers' money	1623
Total expense of raising 18,739 barrels, 6 cwt.	7879
The value of coal sold at the increased price, was	8375
Culm or small	687
	9062
Leaves profit	£1183

£3000 was more than the proprietors had reason to expect.

As the colliery extended, and the expenses increased, it gradually became not only unproductive but a very losing concern; and as the working was carried on without any rule by every small tenant, not only a great deal of valuable coal was lost by the overrunning of it, but another large proportion stolen, or sold, by the master colliers, who had the working in their respective lands without accounting. The collieries were advertised to be let, but no one was found to adventure, whereupon Mr. Curr was brought over from England, to endeavour to re-arrange matters after a proper form; but it does not appear that much was effected, the master colliers having so great a hold of the property.

In 1802, a ton of coals cost at the colliery 18s., and in the town of Castle Comer it was retailed at 13d. per cwt.; in Kilkenny, (12 miles) the price was from 25s. to 40s. per ton, being a summer day's work with 7½ cwt.; but the roads round the colliery were exceedingly bad. Whilst coals were sold at the pits for 20s., culm sold for 18d. per kish = 4s. 6d. per ton. Culm is greatly used by the poor people in making up clay balls.

In the year 1800, there were 16 pits at work; and several years before, there used to be 24 pits, each pit raising from 10 to 15 tons per day.

The proprietors covenanted to sink the pits, including the finding of timber, &c. This was found to be a ruinous arrangement, inasmuch as when any difficulty occurred in working, the pit was abandoned, and a new one required.

Wages in those days were—

Sinkers and colliers	18d. to 20d.	per day.
Hurriers -	16d. to 18d.	do.
Thrusters -	13d.	do.

The depth of the pits varied from 24 to 44 yards; and in the clay overlaying the rock, fragments of green rock prevail, and also those of globular limestone.

Sections of strata, usual depths.

		Ft.	In.		Ft.	In.
Clay, - - -	from	12	0	to	33	0
Green rock - - -		25	0	to	25	0
Grey rock - - -		9	0	to	24	0
Slate, black - - -		21	0	to	24	0
Main top - - -		0	6	to	0	6½
Slate - - - -		15	0	to	15	0
Small mine - - -		0	3	to	0	3½
Slate - - - -		3	0	to	3	0
Coal - - - -		2	6	to	3	1
	Total	88	3		127	11

A few years ago, a trial below was made by boring, which proved as follows:—

	Ft.	In.
Coal seat - - - - - - -	3	6
Whitish hard rock, which was called whinstone	21	0
Black slate - - - - - -	4	0
Thin bed of coal - - - - - -	0	6
Carried forward - -	29	0

	Ft.	In.
Brought forward	29	0
Whinstone	12	0
Slate	4	0
Coal	1	0
Whinstone	12	0
Total	58	0

Three principal leaps, or dykes, appear to extend through the greatest part of the colliery, running nearly parallel for more than a mile, in a direction south-west and north-east; they vary in their course, displaying many curves and turnings.

Two steam-engines were at that time erected in the colliery, of double power; the largest had a cylinder 22 inches in diameter, and 5 feet stroke; it made 30 strokes per minute, and discharged 800 or 1,000 gallons of water, drawn from a depth of 40 yards, consuming 2 tons of coals per day. Expense of setting this engine at work, at Clough, was £1100, and the yearly expenditure as follows:—

	£.	*s.*	*d.*
Coals, 30 bar. per week, at 52 weeks = 1560, at 9s. 9d. per barrel	762	0	0
2 Enginemen, at £1 8s. per week	72	16	0
2 Firemen, at 17s. 4d. per week	45	1	4
Hemp, rope, yarn, oil, lard, candles, iron, and different repairs	100	0	0
Carriage of coals to the engine	32	1	3
E. W. Finlan, engineer's salary	100	0	0
	£1111	18	7

The smaller engine had a 17 inch cylinder, and discharged 500 gallons per minute, from the depth of 36 yards, going thirty 4½ feet strokes per minnte.

This engineer, Finlan, died in 1801; and so rare was this description of person in Ireland, that the collieries were off work for some time till a proper person could be had to manage them.

Besides these engines, six machines, worked by horses, were also employed to raise water, two men and one horse being requisite for each, the men being paid 1s. 1d., and the horse at the rate of 2s. 2d. per day. Barrels, of 42 gallons, were used in the drawing.

For a series of years after Mr. Griffith examined the property, the engines were discontinued; the working consisted almost entirely in re-opening the old level free pits, by means of contract, or master colliers, who raised coal and culm out of the old pillars and barriers, upon the sales of which they received one-half; and although sometimes so far as 50 or 60 pits were working at once, and the coals sold as high as 20s. per ton, yet from the great extent of stealing that was carried on, and the enormous charges of agency, watchmen, &c., the collieries were losing concerns to Lord Ormonde and the other proprietors. So many contracts, real and fictitious, were held by the said master colliers, and so much misery and starvation reigned amongst the workmen, that the district was almost in a lawless state; which was still further increased by the Terryalt system, which then prevailed.

It was under these circumstances that I was requested, in the year 1827, to examine the property, with a view of ascertaining how far it was capable of improvement, or of being made subservient to any such system as practised in England.

The state of misery and wretchedness which then prevailed cannot be described; the face of the property was studded over with the most wretched cabins, many of them without either door or window; the adults in a state of squalid poverty, covered with rags; the children without clothing; their beds, consisting of a heap of stones piled up in the corner of the mud cabin, with a covering of straw, and upon that a blanket; their houses without furniture, save a pot for boiling potatoes of which they partook, sitting round it upon the mud floor; one third of the people without any employment or means of subsistence, other than by begging of their poor neighbours, and those who were employed scarcely ever saw money, being subsisted chiefly with butter milk, and potatoes from the shops of the master colliers; in short, the state of the people may be judged of, when I aver that most grateful would they have been for employment at the rate of 4d. or 6d. per day.

The dreadful feeling was increased by the reflection, that it was very difficult to suggest any means of providing them with work, since there was no plan to shew where the probability lay of obtaining scraps of whole coal; and the engines having been long dismantled, those parts where the whole coal was said to remain were under water, so that it was only in the level free parts of the old pillars that any attempt could be made for extending the works.

There were then about 60 pits working, the pillars averaging about 1½ by 2 yards, and the openings about 5 feet wide, and generally fallen; seam 32 inches thick; no one could judge in what direction to drift in search of these trifling pillars, or of the ribs, or barriers, between pit and pit, which were seldom more than 100 yards from each other. Some idea may be formed of the manner in which the colliery had been worked, when I state that from first to last not less than 1200 shafts have been sunk upon the property.

The general price of the contractors at this time was 10s. 2d. per ton of 21¼ cwt. for coal, and half the selling price for culm. The best coal sold for 16s. 8d.; the second or red coal 8s. 4d.; and the culm 3s. 4d. per ton; the culm averaging about twice the quantity of the coal.

The establishment I found to be as follows:—

Colliers - - - -	1000	
Hurriers 200, Thrusters 300	500	paid 1s. 8d. per day.
Pullers at pit top - -	300	paid 1s. 6d. per day.
Scavengers - - -	70	
	1870	

Proprietor's staff—

Agents and clerks -	18	
Weighmen - - -	2	
Rangers and watchmen	80	
Roadmen and labourers	15	
	—	115
Total -		1985

Pit's company and wages—3 feet coal—

20 Colliers	2s. 0d.	each	£2	0	0
4 Thrusters	1s. 8d.		0	6	8
4 Hurriers	2s. 0d.		0	8	0
2 Pullers	1s. 6d.		0	3	0
1 Scavenger	1s. 6d.		0	1	6
31			£2	19	2
	Candles			5	10
			£3	5	0

Will produce about 12½ tons of coals, and 11 tons of culm.

Had then at coal work, from 60 to 70 pits—Section—

	Yds.		Ft.	In.
At	6	Top seam	2	3
Further	13	Stone coal	2	10
	44	Three Feet coal	2	6
Supposed	50	Four feet coal	4	0
	109		11	9

The four feet coal at Rock, was 32 yards deep.—

	Ft.	In.
Top coal, good	1	6
Parting kelve	0	2
Bottom coal, inferior	1	0
	2	8

The custom with the middle men was, to hold part of the colliers' wages in hand until the stocks were run off; by which time, their debts at the shops had generally so absorbed their earnings, that they scarcely ever saw money.

Bad sledges were used underground; some gins were employed; but the coals were mostly drawn up by hand-windlasses. Owing to the number of pits, the land throughout the colliery district was in state of general waste.

Upon the coals being landed, they became the property of the owners; but so great was the inducement to stealing, and to the covertly selling the coals by the master colliers, that 50 or 60 police and watchmen were requisite, at the cost of £1,500 per annum, to check the peculation; and this was nearly ineffective.

The master colliers had, or pretended to have, contracts for working, out of which they were making profit; they therefore had no interest in any measure of concentration, or of bringing the concerns into a mode of management, similar to those of England, even if such could have been effected.

In the mean time, the whole property was over-stocked with the most appalling pauperism that could be witnessed, without any poor-law, and without the means of finding employment; whilst improvements, without great extension of quantity, would tend to increase that misery. I, therefore, directed my attention to the lower four feet coal, which I concluded to exist over a great extent of property. It had formerly been bored to, and which borings represented that it lay at the depth of 25 or 30 fathoms, and upwards of 4 feet thick.

In pursuance, therefore, of a new establishment upon the four feet coal, a proper winning was commenced on the 16th of October, 1827. The gravel, with sand and water, was found to be 12 yards deep, but which was commanded by a pumping engine, followed up by a plank tubbing, the first that had been applied in Ireland. The sinking was thus completed in Feb., 1829, being 30 fathoms deep, and which proved the four feet coal not to be as represented by the borings—but as follows:—

July, 1829.	So. Side of Workings. Ft.	In.	No. Side of Workings. Ft.	In.
Top coal - - - - - -	2	9	2	1
Coarse—bottom coal like black slate	1	2	0	5
	3	11	2	6

This pit soon required forty-five hewers, who were paid the enormous price of 4s. 9d. per ton—selling price 13s.

per ton. It was, moreover, so difficult to work on account of the roof and thill being hard and so highly sulphureous, that it would not sell at near the price of the three feet coal. It was, however, fitted up with tram-ways, extended to a very considerable distance, and would have laid the foundation for a permanent colliery, had the quality of the coal borne it out, which was not the case; the adventure was also interrupted by one of these fatalities, which have so often blasted the prosperity of the country, viz., the barbarous murder of Thomas Potts, one of the English agents, without any seeming cause, on the 14th of March, 1832. It was accomplished in open day, and in the presence of several persons. This, together with the scraps of whole coal being exhausted in the three feet seam, and an indispensable return to the old straggling mode of working, broke up the arrangements in the year 1833.

The above murder was committed by persons from a distance, at the instigation of some of the middle men; and, although the names of the murderers were well known, no evidence could be procured whereupon to rest an apprehension, till at the end of seven years one of the parties was tried and executed for it.

The following table will shew the rate of produce during three years:—

1828.

	Coal. Tons.	Culm. Tons.	£
New Collieries	10,496	4,542	8,533
Old Collieries	14,288	18,678	12,179
	24,784	23,220	20,712

Total of coals and culm 48,004
Average per ton 8s. 8d.

1829.

	Coal. Tons.	Culm. Tons.	£
New Collieries	5,097	2,978	3,990
Old Collieries	11,833	13.296	9,766
	16,930	16,274	13,756

Total of coal and culm 33,204
Average per ton 8s. 3½d.

1830.

	Coal. Tons.	Culm. Tons.	£
New Collieries	4,057	3,520	3,120
Old Collieries	10,980	11,988	8,873
	15,037	15,508	11,993

Total of coal and culm 30,545
Average per ton 8s.

The quantity to the ton was 21 cwt.

The Grand Canal Company's adjoining colliery at Donaan, in Queen's County, (now working by Mr. Edge), has been conducted in a similar manner to that of Castle Comer, and was thus described by Mr. Coote, in his survey of Queen's County, in 1801.

In 1801, there was an engine at Donaan which at each stroke raised a hogshead of water.

Great waste of coal was carried on, by leaving pillars unnecessarily. A barrel of coal, 6 cwt., sold for 6s. at the pits; the colliers who raised them had 2s. 6d. per barrel.

"An idea of the value of these pits may be formed, when, without the assistance of an engine, and not one shilling of capital, except the cost of sinking, seven pounds sterling clear profit per week has been returned from the old pits to the proprietor; and the new coal would be well worth, now, three times that sum, but nothing effectual can be done without an engine."

"The rock above the coal is greenstone, usually from 10 to 50 yards thick. Pits were generally 6 feet diameter. The colliers are divided into clearers, breakers, fillers, and hurriers; each hurrier draws his load 20 yards, which is a stage."

"In Donaan pits and Castle Comer adjoining, a pit double-worked, will employ about 60 hands."

"The colliers are well able to earn from 3s. to 5s. per day by their trade; and would be all wealthy, but from the unconquerable propensity to whisky, which consumes all their profits."

The roads were bad, nothwithstanding 1500 cars have been counted in one day, on the Cooper-hill road alone.

Taking a general survey of the collieries, about 1200 hands are daily employed; but were all the pits at work, that number might be doubled, exclusive of the men and boys who attend the cars, which cannot be less than 3000.

Valuable as these collieries might have been, yet about the year 1798, they were worked by the Grand Canal Company of Dublin, and were laid in because they could not be made profitable. They were afterwards opened in 1803, but without success; and they have since been let to Mr. Edge, who has pushed them with spirit, and has been very well repaid for his adventure, being at present in a good way of production.

The Rushes colliery has been lately founded by an English company, six miles east of Castle Comer, on the road to Carlow; it is supposed to be working one of the lower beds of slate coal, thickness 2½ feet, the upper part of which is very slaty, and the seam itself greatly inferior to the Castle Comer seam.

Strata passed through in sinking

	Yds.	Ft.	In.
Clay - - - - - - - -	8		
Black and blue bind - - -	26		
A seam of coal - - - - -		0	9
Black bind - - - - - -	2		
Greenstone - - - - - -	16		
Very *black* rock—very hard, in layers of 3 or 4 inches thick, and soils the water like ink - - -	13		
Coally slate - - - - - -	7		
	72		

Coal 2½ feet, with fire clay seat.

Present prices—Coal 12s., Culm 3s. 4d. per ton. The Donane and Castle Comer selling for 15s. and 5s. per ton.

Colliers' wages 2s. per day.

They have 60 hewers and 18 putters for raising 500 tons of coal and culm per fortnight.

Watchmens' wages from 4s. to 5s. per week; banksmen 1s. 2d., and enginemen 1s. 6d. to 1s. 9d. per day. Wages at this place, higher than at any of the neighbouring collieries.

Culm Beds, in the County Limerick.

I had an opportunity of examining some culm beds, (anthracite coal,) at Glenagower and Loughill, in the county of Limerick, and in the neighbourhood of the Shannon.

Glenagower.

Depth of pit 23 yards, to culm beds 12 inches (loose small coal), blue slate cover, mixed with iron ore, fire-clay thill.

The colliers sink the new pits, hew, and deliver the culm upon the surface, at 10d. per barrel of 3 to 3½ cwt., the said barrel selling for 1s. 4d.

It is chiefly used for burning lime, and one barrel of it will burn 5 or 6 barrels of lime, each containing 42 gallons. Culm beds, dip, south-south-west, one in three.

Loughill.

Bishop's lease at 2d. per ton, sublet at 6d. per ton. It is situated upon the south side of the Shannon. It scarcely ever exceeds 14 inches in thickness, and sometimes pieces of coal are got 6 or 8 inches square. Upper stratification, almost all blue slate, mixed with much ironstone. Here the colliers have 9d. per barrel for raising, and the barrel sells for 2s. 6d. Here they say, that one barrel will burn 8 barrels of lime for building, and for manuring 9 or 10 barrels. Coals are drawn in half barrels by jack-rolls.

The water of this colliery is equal to 12 gallons per minute, and occupies 3 horses and four men in drawing with buckets.

The pulling work for about 10 working colliers, requires four banksmen and one salesman, and have always four colliers sinking. Total raisings, 6000 or 8000 barrels annually.

This place is well situated for water carriage to Tralee, Limerick, &c.; freight from hence to Limerick, 30 miles, 2s. 2d. per ton, each boat carrying about 100 barrels, or about 15 tons. The Shannon is here about 1½ mile broad.

This same culm bed seems to extend over a great neighbourhood, but has been very little explored; it frequently blazes, and takes fire spontaneously. Valuable as this culm might be made, it is not subjected to any research, nor to any scientific mode of working; although there is abundance of limestone in the district, and lime is so much wanted in the improvement of the lands.

BELGIAN COAL FIELD.

GEOLOGY AND EXTENT, DEPTH, NUMBER OF SEAMS, QUANTITIES OF COAL RAISED AND THEIR SELLING PRICES, POPULATION, QUANTITY EXPORTED TO FRANCE AND HOLLAND, MODE OF WORKING AND OF VENTILATING THE MINES, ETC.

It is not a little surprising that the statistics of this coal field should be so little known in this country, more especially amongst the people of the north of England, who are so materially interested in its condition and capabilities The surprise is increased, when we consider how convenient the access, and how replete this coal field is with interesting facts, both to the geologist and to the practical engineer.

The general disposition of the strata, both coal and rock, seems considerably more minutely divided than in England. For instance, at Angin, near Valenciennes, a pit, less than one hundred yards in depth, passes through 500 layers; at Liege, 61 have been asccrtained; in England, the alternations average in thickness 4 or 5 feet each; but it is worthy of remark, that the coal seams of Belgium are thinner and more numerous than those of this country, and are accompanied with a greater proportion of the shales and other soft metals, to which circumstance may be attributed the remarkable absence of water from the coal, and from the lower series of the accompanying stratification, which is particularly exemplified in the Hainault district, by the fact that whilst the coal engines, 145 in number, amount in the aggregate to 3881 horse power, the pumping engines are 58, amounting in horse power to 5279 only; and average only ninety horse power per engine, although many of the mines are upwards of 150 fathoms in depth.

I apprehend, that the coal field about to be described is entitled to the appellation of the richest coal deposit in Europe, extending almost continuously through the north of France, in a belt of about 150 miles in length, and from 6 to 10 miles in breadth, including the districts of Valenciennes, Condé, Mons, Namur Liege, and a considerable portion of the Duchy of Limburg towards the Rhine, and containing in the centre of the basin no less than 134 workable seams of coal.

I have, during the last year, visited some of the principal scenes of coal operations, and have ascertained by actual inspection, both above and below ground, the general practice of mining. And having been favoured by Mons. Vischers, the minister of public works, with statistics, published by authority of the government, up to the end of the year 1838, I trust that I shall be enabled to place before the reader a series of very interesting facts.

French Measures, &c., used in this Work.

	Inches		
A Metre	39·371	Decimetre	3·937
Decametre × 10	393·710	Centim	0·393
Hecametre × 100	3937·100	Millim	0·039
Kilometre × 1000	39371·000		
Myriom × 10,0000			

	Square Yards.
An Are	119·6046
Decare × 10	1196·00
Hectare × 100	11960·

French foot—Old Measure, 12·78 inches.

	Cubic Feet.
Decistere	3·531
Stere	35·317
Decastere	353·17

	Cubic Inches.	Imperial Measure. Galls.	 Pints.
Decilitre	6·102		
Litre	61·028		1·76
Decalitre ⋈ 10	610·280	2	1·60
Hectolitre ⋈ 100 .. .	6102·8	22	0·08
Kilolitre ⋈ 1000	61028·	220·	0·08
Myris ⋈ 10000......	610280·	2201·	

	English Grains.	Troy Weight. lbs.	 oz.	 dwts.	 gr.
Gramme	15·440				
Decagramme ⋈ 10 ...	154·44	0	0	6	10·44
Hectogramme ⋈ 100 ..	1544·4	0	3	4	8·40
Kilogra ⋈ 1000.........	15444·	2	8	3	12·02
Myris ⋈ 10000.........	154440	26	9	15	0·23

A Kilogramme nearly 2lb. 3oz. 5 dwts., avoir. = 2·2lb.
A Franc 10d.

Coal Fields.

Belgium is traversed in direction nearly from west to east, by a zone of carboniferous strata, containing a great variety of different beds. This zone is divided into two principal basins; one commencing to the rise, the other to the dip of the deep and narrow gorge, through which the Samson river flows, in the province of Namur.

The coal field of Hainault, or the western division, which is the most important, passes by Namur, and the valley of the Sambre, constantly expanding till, at Charleroy, it attains its greatest width, viz., 10½ miles from north to south.

The coal field then continues in width of about 7 or 8 miles near Mons, Valenciennes, and Douai; beyond which, it is but imperfectly explored.

This province contains two districts; the first consists of the judicial arondissment of Mons and Tournay, the second of Charleroy.

There are very few countries so rich in coal as Hainault.—The coal basins traverse the two districts from west to east, for a length of more than 40 miles, (22 killom. per mile,) and upon a mean width from north to south of about 8 miles, occupying a surface of 78,000 hectares, or 31½ square leagues of 5,000 metres each.

This coal field is divided in the arondissment of Charleroy by calcareous dykes, extending from Fontaine le'Eveque to Mont sur Marchienne the middle part being scarcely a mile and half broad, and containing only a small portion of coal.

Hainault possesses almost every description of coal, from qualities the most common and poor, (called by some authors by the name of anthracite,) up to the richest and finest coking coal, such as the blazing coal called Flenu, analogous to that of Newcastle, in England, and which is in great request for all manufacturing purposes.

The length and superficial contents, therefore, of this coal basin may be stated as follows :—

	Length Miles.	Area Hectares.	Square Miles.
Province of Namur	18	14·326	51
Hainault - -	39	75·725	274
Northern department	27	69·025	253
	84	159·076	578

Comprehending in Belgium 326 square miles.

A vast number of seams are known to exist, of various thickness, of which a yard may be called more than an average, and comprehending almost every quality of coal.

In the vicinity of Mons 114 seams are well known, amongst which the Group Flenu, containing 52 beds, are the richest; but to reach which a considerable sinking and pumping of water are needful.

The first steam engine for raising water was erected in the district of Charleroy, in the year 1725, by a person of the name of Mesonne; and in the district of Mons, about the year 1735, by a person of the name of Goffint, both belonging to Liege.

The stratification of the mines in the neighbourhood of Mons is very regular, but they scarcely ever attain the extraordinary thickness of the English mines.

Coal Field of Liege.

Before the treaty of peace, in 1839, Belgium possessed many mines of coal upon the right bank of the Meuse, in the province of Limburg; but at that period, a considerable portion of the colliery district was ceded.

The part of the basin that remains, forming the coal field of Liege, as compared with the aforesaid district, lies at an angle of 32 degrees. It follows the valley of the Meuse, gradually widening, till it attains its greatest expansion opposite to Liege, where its width, from north to south, is 9 miles. It appears to be continuous into the Duchy of Limburg (Low Countries), where several mines are worked by the Prussians, at Rolduc, and at Eschweiler. The extent of this basin is—

	Length	Superficial Contents.	
	Miles.	Hectares.	Sq. Miles.
In the province of Namur	6	2,347	8½
Liege	33	41,745	151½
Total	39	44,092	160

The working of coal at Liege, is known to have been begun about the end of the 12th century; and the first steam engine for raising water, was erected in 1723, and only four were in operation in 1767.

The seams of coal at Liege are not so numerous as at Mons; notwithstanding, they furnish nearly all the qualities necessary for the various purposes of manufacturing, as both Liege and Charleroy may be esteemed the centre of the manufactures of Belgium.

The proportionate coal mining districts of France, England, and Belgium, are stated as follows:—

	Sq. Miles.	Proportionate Mining Area to that of the Kingdom.
Great Britain, England, and Scotland - - - -	4251	1-20th.
France - - - - -	914	1-210th.
Belgium - - - - -	486	1·22nd.

According to this estimate, Belgium possesses a proportion of coal mining ground, to the general area, the second rank in Europe.

The quantities of tons raised by each country, are stated to be as follows:—

		Tons—English.
Great Britain - -	in 1835	24,000,000
France - - -	in 1838	2,944,694
Belgium - - -	in 1838	3,260,271

The following tables also exhibit the relative proportions of coal raised by Prussia, France, and Belgium, about this period.

Summary of the Prussian coal mining, from the government records:—

	No. of mines in account.	Pits.	No. of workmen.	Population belonging to them.	Quantity of coal raised. Tons.	Value in francs.
1837	331		16,218	59,747	2,078,696	13,978,891
1838	339	628	17,884	42,237	2,308,368	16,121,160
1839	364	651	19,570	44,710	2,442,632	17,833,605

Quantity of coal raised in France during 15 years:—

Years.	Tons.	Years.	Tons.	Years.	Tons.
1825	1,491,400	1830	1,760,400	1835	2,506,400
1826	1,541,000	1831		1836	2,842,000
1827	1,691,100	1832	1,962,900	1837	2,980,700
1828	1,774,100	1833	2,057,600	1838	3,113,300
1829	1,862,700	1834	2,489,800	1839	2,994,900

During the year 1838, France employed 23,751 workmen, and raised coals to the value of 29,078,083 francs; working pits 157, sinking pits 64, equal 221; whilst Belgium employed 37,171 workmen, and raised 3,260,271 tons, the number of concessions being 307, 266 of which were in activity, and 41 lying dormant; and the number of working pits was 480, and 172 in course of sinking.

The report goes on to state the particular boundaries and other details of each district, but which do not possess much interest to the general reader unacquainted with the localities.

Suffice it to say, that in the neighbourhood of Charleroy 114 seams are recognised; and to the westward of Mons, no less a number than 131 workable seams are known to exist. The lowest 36 seams furnish a comparatively inferior coal; from 35 up to 64, the quality resembles the Newcastle coal, and is fit for smiths' use, &c. The upper 77 seams are similar in nature to the foregoing, but of superior quality; the superior series of which are of a kind peculiar to this district, and which find a ready sale, both in the country and in France, under the name of Flenu, being very rich, pure, and free from sulphur. Anthracite is also found in the district of Hainault, and in many cases the coal field is narrowed and interrupted, especially towards the southern outcrop, by the most extraordinary doublings and zig-zags, which pervade all the seams, and which may be likened to the course of lightning.

The coal mines belong, *prima facie*, to the government, which lets them in certain concessions, or leases, the ancient custom being to include a certain number of seams. Different lettings afterwards taking place, to different companies, of other seams contained within the same area, with necessary powers to sink through each other's concessions. The inconvenience of this mode of letting has of late years been severely felt, and which inconvenience the government have a desire to remedy; but which will require a very long period to counteract, under the numerous existing leases.

The working of coal in Belgium was of comparatively small import, until the years 1803, 4, and 5, when the encampment of the armies of Buonaparte at Boulogne, preparatory to the intended invasion of England, and the embargo laid upon English coal, caused an immense demand to take place from this quarter. Numerous companies, in consequence, arose; great capital was brought forward, and the foundation was laid for the future importance of Belgium.

Previous to this period, and in ancient times, societies of workmen united to sink and carry on those mines, who were so far encouraged by the government as to be entitled, when possessed of a certain interest, to vote in the state assemblies; but these privileges and companies gradually declined in proportion as the sinkings became deeper, and skill and capital became indispensable.

In 1834, much speculation in coal mines took place in this country, Several large companies were established for the erection of engines, and the working of collieries, upon a scale hitherto unknown. Mines were leased and speculated in, to an extraordinary extent; iron furnaces were built, and works extended beyond bounds, until, like their English neighbours, they surpassed all legitimate demand.

Mr. Tennant, M. P., who visited this country in 1842, says that between the years 1833 and 1838, not less than 150 joint stock companies, called "Societe Anonyme" were formed, for the purpose of working mines, carrying on glass-works, sugar refineries, and in short every sort of trade, and that not less than 15 millions sterling of capital were expended in these objects. And Mons Briavionne, upon "*l'Industrie de la Belgique*," in 1839, states "that since 1830, different companies, whose capitals amount to nearly four millions of pounds sterling, have been established in Belgium, for the purpose of working the coal mines.

These speculations suffered severely by the separation from Holland in 1830, and by the remission of the English export duty upon coals in the year 1834, which greatly checked the produce of this district in the markets of France and Holland, which had previously been laid open by the peace of 1815, and which also opened the markets of the continent to English manufactures, to the great injury of the coal-working districts of Liege and Charleroy.

Since the revolution of 1830, which withdrew Belgium from Holland, great pains have been taken by the government to encourage and improve the working of the mines. In 1836, a minister of public works was appointed head of the mining department, who is assisted by district agents in every part of the country, whose duty it is to collect and transmit returns, embracing almost every subject connected with the carrying on of the mines, the nature of the various accidents, and the means of preventing them, affording accounts of the various pits and their depth, the number of people employed, quantity of tons raised, selling prices of coal, and, in short, every species of information calculated to enlighten the government, and enable them to legislate upon this, to them, all important article of their national commerce.

In 1838, the thirst for speculation had reached its maximum ; the consequences of over-working were beginning to be apparent; the exorbitant premiums upon collieries and coal leases, which had hitherto been paid were at an end, and a retrograde movement took place. In short, the eyes of the public became opened to similar facts, and from similar causes to those so fatally experienced in our own coal districts; ruin ensued, and the collieries, at this moment, are only enabled to procure sales for half the quantity they had been calculated to raise.

To a state of fictitious prosperity of 1838, has succeeded a ruinous crisis. The nation has expended in vain those resources which might have been better employed; but whatever evils may have befallen the adventurers, they have had the effect of benefiting the consumers.

The extent to which these speculations was carried on, will be estimated by the statement, that in the year 1838, the " Civil Societies" possessed 224 out of the 307 collieries of the Belgian kingdom.

Forty-three mines have been acquired wholly or in part by " Anonymous Societies," in consequence of subscribed capital being brought in; and the following tables will shew the number of pits which they respectively purchased or established during the latter years, and the quantity of coal which they raised for sale; at the same time I may remark, that such excessive speculations are not commendable.

Mines acquired in which anonymous societies were interested :—

	No. of mines.	No. of working pits.	Tons raised.
1834	83	92	899,871
1835	83	100	1,004,291
1836	83	153	1,244,625
1837	83	210	1,311,311
1838	83	271	1,285,427

Mines remaining in the hands of individuals or ancient societies :—

	No. of mines.	No. of working pits.	Tons raised.
1834	224	249	1,543,697
1835	224	252	1,643,088
1836	224	318	1,807,338
1837	224	345	1,917,486
1838	224	389	1,974,844

Coals from the province of Hainault have, for their principal outlet, France and the provinces of the two Flanders, Antwerp, Brabant, and Namur. The produce is conveyed by the canal of Mons to Conde, the Escaut, and the canal of St. Quentin—by the canal of Mons to Antoing, to Escaut, and the Lys—by the Dondre—by the canal of Charleroy to Brussells—by the Sambre (made navigable,) and the Meuse—by the Sambre and Oise—and also, by a great number of paved roads which connect the mines with the surrounding towns and villages.

The quantities of coal conveyed by the rivers, in the neighbourhood of Mons, into Flanders, Holland, and France, during late years, are as follows : —

	1829. Tons.	1830. Tons.	1831. Tons.	1834. Tons.	1838. Tons.
Flanders and Holland..	477,600	546,000	390,400	430,400	596,860
France	390,240	421,560	386,400	493,200	601,440
Total......	867,840	967,560	776,800	923,600	1,198,300

The quantity of coals sent from the collieries of Charleroy into France, partly ascending and descending the Meuse and canals, were as follows :—

		Tons.			Tons.
1830	about	200,000	1832	- -	149,044
1831	- -	120,517	1833	- -	175,838

In 1833, the opening of the canal of Charleroy to Brussels conveyed 175,000 tons of coals from the collieries in that district; and the canal of the Sambre and the Oise was opened in the beginning of 1839.

The average wages of workmen in the collieries about Mons, from 1830 to 1834, was from 1½ to 2 francs per day, and in 1836 to 1838, 2¼ francs.

In the district of Charleroy, in 1836, about 1¾ francs.

From the Hainault district to Paris is about 180 miles, by which a considerable quantity of the best coals finds its way.

The produce of the Liege coal field is consumed, mainly in the district, by numerous manufactures; but the surplus is also carried off to France and Holland by the water carriage of the Sambre and Meuse, and the paved roads, which traverse the country.

The classification of these numerous seams is in some degree hypothetical, as they are traced from their respective outcrops and the successive sinkings upon some or others of them ; but the theory of the aforesaid number of seams is universally admitted by the mining engineers. The depth of the pits is exceedingly variable. I descended some of them in the Mons district, 180 fathoms in depth, which were working *the upper or Flenu beds ;* and as these collieries were known to be situated very near to the bottom of the basin, it was computed, that a sinking of 900 fathoms would be required to command the lowest coal. The western coal field is overlaid by a formation of chalk and flint, varying according to the sinkings, from 20 to 140 yards in thickness, and giving out water ; but the coal stratification is remarkably free from water, and, from the information I received, it is, generally speaking, composed of argillaceous strata.

The price of coals, in 1838, was higher than at any previous period, and had been gradually increasing during the preceding nine years, at the rate of 5 per cent. per annum.

In the province of Namur, the mines are less deep, the workmen worse paid, and altogether it is upon so small a scale as scarcely to rank as a coal field, except in conjunction with the other two.

The price of coals, of course, varies according to quality, and the mode in which they are prepared for market.

In the Mons district—Flenu coal—

1838.

	Francs.	Killo.	Per Ton. s.	d.
The picked large coal (Gayette)	1·70 per Hect.	80	= 19	10
Second Ditto - - -	1·40		= 16	4
Small - - - - - -	0·60		= 7	0
In the Centre district—				
Large coal - - -	20 per thousand Killo.		= 18	8
Small - - - - -	10 Do.		= 9	4
Charleroy—				
Coking coal, large - -	22 Do.		= 20	6
Small - - -	15 Do.		= 14	0
House coal, large -	22 small 11		= 20	6
Common coal - -	18 small 7		= 16	9

The English ton is 2,240 ℔s.

These prices are received at the canals, and the conveyance from the collieries may be taken at 9d. per ton, say 1s.

Table of the quantity of coals raised, and also of that exported to France and other countries:—

	Total Produced. Tons.	Total Exported. Tons.
1831	2,270,000	468,000
1832	2,249,000	1,287,000
1833	2,708,000	576,000
1834	2,747,000	654,000
1835	2,902,000	685,000
1836	3,143,000	761,000
1837	3,263,650	789,000 value 12s. ⅌ ton.
1838	3,685,402	775,000
1839	2,812,256	

It is a fact worthy of notice, that in the province of Liege, during the year 1828, 9,267 workmen only produced 570,000 tons; whereas in 1836, 7,375 workmen produced 628,000 tons, arising mainly from the successive improvements that have been carried out in the working of the mines, by the application of horses and machinery.

Royalty Rents.

I have before observed, that the royalty over all the mines belongs to the government, who regulate the rent according to general policy. The law of the 24th of April, 1810, fixed the principle as follows:—1st. A certain or sleeping rent, in proportion to the extent of coal leased, or promised to be leased, and regulated accordingly from time to time. 2nd. A tonnage rent (Redevance,) is fixed annually by government, which is levied, not exceeding 5 per cent. upon the net produce of the mine; the mode of taking such amount is regulated by an imperial decree of the 6th of May, 1811.

The tonnage rent subsequent to the year 1823, has been fixed at 2½ per cent., upon the saleable produce.

A table of certain, and tonnage rents payable from the mines of Belgium during 18 years:—

	Certain rents paid to the Government.				Tonnage rents founded upon 2½ per cent. upon net value of produce of mines.			
	Province of Hainault.	Namur and Luxemburg.	Liege.	Total.	Province of Hainault.	Namur and Luxemburg.	Liege.	Total.
	Francs.	Francs.	Francs.	Francs.	Francs.	Francs.	Francs.	Francs.
1823	10,652	1,857	2,735	14,244	65,154	4,223	30,542	99,919
1824	10,589	1,696	2,618	14,903	48,748	4,544	29,405	82,697
1825	10,715	1,696	2,642	15,053	51,512	4,476	30,069	86,057
1826	10,648	1,326	2,649	14,623	56,308	4,469	33,747	94,524
1827	10,586	1,756	2,657	14,999	57,041	3,989	42,147	103,177
1828	10,614	1,906	2,717	15,237	46,198	5,110	46,424	97,732
1829	10,439	3,876	2,894	17,209	43,529	4,979	50,584	99,092
1830	10,807	3,885	3,204	17,896	42,463	3,900	49,785	96,148
1831	11,027	3,970	3,306	18,303	34,189	3,444	23,125	60,758
1832	10,759	3,971	3,314	18,044	28,330	2,983	12,592	43,905
1833	10.756	3,960	3,215	17,931	30,129	2,789	10,004	42,922
1834	10,587	3,961	3,206	17,754	30,304	2,387	19,269	51,960
1835	9,526	3,960	3,215	16,701	29,381	2,244	20,053	51,678
1836	8,650	3,961	3,214	15,825	32,529	1,821	34,968	69,318
1837	8,645	3,961	3,214	18,200	47,237	1,868	49,291	98,396
1838	8,585	3,960	3,216	15,761	109,830	4,706	56,035	170,571
1839	8,622	4,016	3,236	15,874	91,044	1,944	47,203	140,191
1840	8,621	4,032	3,257	15,910	93,195	4,053	43,792	141,040

Retrospective results during the last three years, with Tables, shewing the General Statistics of the Coal Mine Districts.

A table of the working and sinking pits, with the number of workmen, and quantities produced, viz.:—

Provinces	No. of mines leased.	Workings. 1836	Workings. 1838	Sinking. 1836	Sinking. 1838	Workmen. 1836	Workmen. 1838	Quantity of tons for 1836	Quantity of tons for 1838
Hanault	154	251	318	39	123	20,880	25,241	2,349,374	2,415,909
Namur	38	46	57	23	33	880	1,282	79,174	103,954
Liege	115	92	105	19	16	7,375	10,648	627,916	740,408
Total	307	389	480	81	172	29,144	37,171	3,056,464	3,260,271

A table of the average quantity of coals produced by each division, and also by 100 workmen during three years, viz.:—

	Average per pit. 1836	1837 Tons.	1838	By 100 workmen. 1836	1837 Tons.	1838
Hainault, Mons, and Charleroy	9,360	8,726	7,577	11,251	10,732	9,571
Namur - - - - -	1,721	1,967	1,823	8,905	8,866	8,108
Liege, right and left bank of the Meuse - -	6,825	6,440	7,052	8,514	7,159	6,953
Average - -	7,857	7,439	6,792	10,487	9,676	8,771

The average produce of each pit, and also of 100 workmen in each particular district:—

	Average tons per pit per annum. 1836	1837 Tons.	1838	Produce of 100 workmen. 1836	1837 Tons.	1838
Hainault and Mons -	16,558	16,649	15,518	10,959	10,901	10,044
Charleroy - -	4,826	4,192	3,465	11,939	10,366	8,680
Namur - - - -	1,721	1,967	1,823	8,905	8,866	8,108
Liege, left of the Meuse	6,985	6,378	7,168	8,204	6,871	6,411
Do., right of the Meuse	6,634	6,450	6,943	8,936	7,537	7,764

In France, they estimate 5095 tons to be the average produce of each pit, and 11,536 tons for each 100 workmen per annum.

In 1828, the Mons district averaged 13,800 tons per annum, equal to 46 tons per day for each pit.

In 1838, there were 97 steam engines for drawing coals, and 38 for raising water, with 178 working and sinking pits, in the district of Mons.

In 1828, Liege had 103 pits, raised 570,084 tons of coals, and employed 9267 workmen.

It will be seen by the annexed tables how widely the different districts differ in respect to the quantity of people and the number of tons produced by each pit, being influenced by the depth of the shafts, the quantity of water, the hardness of the roof and thill, the number of shafts, and, in short, the nature of the appendages necessary to the working and conveying the produce to the place of sale.

Statement of the proportionate number of men, women, and boys employed in the Liege district, with the average daily wages:—

Years.	Men.	Women.	Boys.	Total.	Average daily wages.		Quantity of Tons produced.
					F.	C.	
1828	5,665	1,521	2,081	9,267	1	25	570,084
1831	5,124	1,213	1,461	7,798	1	17	455,536
1832	4,468	1,217	1,075	6,670	1	12	461,873
1833	4,600	885	1,055	6,540	1	19	508,405
1834	4,680	890	1,060	6,630	1	25	520,000
1835	5,132	861	934	6,927	1	39	591,931
1836	5,070	905	1,400	7,375	1	58	627,916
1837	6,745	1,228	1,376	9,349	1	78	666,729
1838	7,580	1,451	1,617	10,648	1	85	740,408

The quantities in 1829 and 1830 are similar to those of 1828. The produce of round coal (Houille Grosse) compared with chinly coal (Menu) is only about one-seventh, the former selling at about 18s. per ton, and the latter 6s. per ton; mean price about 8s. per ton.

General Statistics of 1838.

Upon the subject of accidents, no less than 131 folio pages are devoted to a detailed statement of every accident that has occurred, from the years 1821 to 1840 inclusive, the causes and places in which they occurred, and the results, which the following tables will shew;—

Proportionate number of accidents in each district, &c., from 1824.

		Hainault.			Namur and Luxemburgh.			Liege.			Total.		
		No.	Killed.	Wounded.	No.	Killed.	Wounded.	No.	Killed.	Wounded.	No.	Killed.	Wounded.
In Pit Shafts.	Number of ropes and chains	102	108	26	12	12	2	112	141	22	226	261	50
	Ladders - - - - -	76	60	23	3	8	1	16	11	6	95	73	30
	Other circumstances - -	122	115	19	12	8	4	128	109	30	262	232	53
	Fall of stones - - -	199	178	46	39	28	17	151	128	51	389	334	114
	Fire - - - - - -	70	211	244	2	1	3	58	293	225	130	505	472
	Water - - - - - -	16	136	16	0	0	0	13	32	0	29	168	16
	Explosions - - - - -	20	9	15	2	2	1	53	20	63	75	31	79
	Divers causes - - - -	88	61	51	10	9	2	48	36	15	146	106	68
	Total - -	693	878	440	80	68	30	579	770	412	1352	1710	882

The number of workmen during this period, varies from 20,000 to 28,000 persons.

Comparative Statement of the produce of the pits and workmen, in the different colliery districts, during the years 1836, 1837, and 1838.

DISTRICTS.	Number of Mines.	Working Pits.			Sinking Pits.			Numb. of Workmen.			Tons raised.	Tons raised.	Tons raised.
		1836	1837	1838	1836	1837	1838	1836	1837	1838	1836	1837	1838
Arondissment of Mons and Tournay	69	97	103	109	23	47	69	14,655	15,731	16,896	1,606,158	1,714,908	1,691,549
Charleroy - - - - - -	85	154	180	209	16	30	54	6,225	7,280	8,345	743,216	754,696	724,359
Namur - - - - - - -	38	46	47	57	23	26	33	889	1,043	1,282	79,174	92,473	103,954
Luxemburgh - - - - - -	0	0	0	0	0	0	0	0	0	0	0	0	0
Liege, left bank of the Meuse -	60	50	57	57	11	11	7	4,257	5,291	6,373	349,265	363,558	408,584
Ditto, right bank - - - -	55	42	47	48	8	7	9	3,118	4,022	4,275	278,651	303,171	331,825
Total - -	307	389	434	480	81	121	172	29,144	33,367	37,171	3,056,464	3,228,806	3,260,271
DIVISIONS.													
Province of Hainault - - - -	154	251	283	318	39	77	123	20,880	23,011	25.241	2,349,374	2,469,604	2,415,909
Namur and Luxemburgh - -	38	46	47	57	23	26	33	889	1,043	1,282	79,174	92,473	103,954
Liege - - - - - - -	115	92	104	105	19	18	16	7,375	9,313	10,648	627,916	666,729	740,408
Total - -	307	389	434	480	81	121	172	29,144	33,367	37,171	3,056,464	3,228,806	3,260,271

Surface area of concessions 122,394 hectares, equal to 302,160 square acres.

Table of the number and extent of leases, number of pits, engines, workmen, and quantities raised in 1838.

	Leases.			Extent of Surface.		No.of Pits.		Steam Engines.					
DISTRICTS.	In Operation.	Dormant.	Total.	Granted.	Provis. promised	Working.	Sinking.	Drawing Coals.	Horse Power.	Drawing Water.	Horse Power	No. of Work-men.	Quantities raised.
				Hectares	Hectares								
Mons and Tournay -	53	16	69	22,262	30,345	109	69	97	2264	38	4091	16,896	11,691,549
Charleroy - - -	82	3	85	14,129	16,557	209	54	48	1217	20	1188	8,345	724,359
Namur - - -	36	2	38	10,449	67	57	33	8	170	0	0	1,282	1,103,954
Luxemburgh - -	0	0	0	0	0	0	0	3	0	0	0	0	0
Liege, left bank - -	52	8	60	7,850	6,157	57	7	34	858	23	2229	6,373	408,584
Ditto, right bank - -	43	12	55	10,430	4,147	48	9	24	460	9	933	4,275	331,824
Total -	266	41	307	65,120	57,274	480	172	211	5369	90	8441	37,171	3,260,271
DIVISIONS.													
Hainault - - - -	135	19	154	36,391	46,902	318	123	145	3881	58	5279	25,241	2,415,909
Namur and Luxemburg	36	2	38	10,449	67	57	33	8	170	0	0	1,282	103,954
Liege - - - - -	95	20	115	18,280	10,305	105	16	58	1318	32	3162	10,648	740,408
Total -	266	41	307	65,120	57,274	480	172	211	5369	90	8441	37,171	3,260,271

Besides the above, there were employed the following steam engines in 1838, in the province of Hainault, in deepening pits, 1st district 48 = 1259 horse power; 2nd do. 30 = 792 do.—Total, 78 = 2051.

The total number of steam engines in the kingdom is 1171, amounting in horse power to 32,109.

N. B. The hectare is 11,960 square yards, or 2A. 1R. 35·38P.

The general statistics of the coal trade will be readily appreciated by the perusal of the preceding and following tables, which are compiled from the government returns, viz. :—

The quantity of tons raised, and *bona fide* value of the coals, will be seen by the following authentic returns :—

	Tons.	Value fr.
1837	2,744,658	27,487,876
1838	2,944,694	29,078,083
1839	2,812,256	26,777,970

	Coals raised in Hainault.	No. of colliers in Hainault.	Liege Tons.	Francs.
1829	1,761,118	19,593	570,084	5,829,875
1830	1,913,677		570,000	5,830,000
1831	1,765,010		455,536	3,830,687
1832	1,737,579		461,875	3,484,205
1833	1,945,150		508,405	3,846,654
1834	1,818,553	21,186	520,000	4,068,405
1835	1,965,166	20,868	591,931	5,062,891
1836	2,349,374	20,880	627,916	6,881,112
1837	2,469,605	23,011	666,729	8,910,702
1838	2,415,910	25,244	740,408	10,315,082

The value at the places of sale may be nearly doubled.

A table of the price of coals in their different localities, viz. :—

	Hainault. Gaillette, Gailetterie, small.						Charleroy round smal.				Liege, best round chinly.				Common sort.			
	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.	C:	F.	C.	F.	C.
1829	15	60	10	80	3	60	18	00	7	00	23	00	17	00	14	00	7	00
1830	16	80	12	00	4	20	14	00	7	00	22	00	16	00	13	00	7	00
1831	19	20	14	40	4	20	14	00	7	50	18	50	15	00	12	50	6	30
1832	18	00	13	20	4	20	15	00	8	00	16	00	14	00	12	00	5	30
1833	16	80	12	00	4	20	16	00	8	50	17	60	14	50	13	60	6	22
1834	16	20	11	40	4	20	16	00	8	50	17	80	14	60	13	70	6	50
1835	16	20	11	40	4	20	17	00	8	50	19	70	15	50	13	80	7	00
1836	17	40	13	20	4	80	22	00	15	00	24	00	20	00	17	00	8	50
1837	19	20	14	40	6	00	23	00	19	00	26	50	21	00	18	90	9	75
1838	20	40	16	80	7	80	23	00	19	00	28	25	21	50	19	50	10	50

	Hainault.	Tons.		Amount francs.
Saleable value—	1837	2,744,658	=	27,487,876
	1838	2,944,694	=	29,078,083
	1839	2,812,256	=	26,777,970

After the enactment of the Anonymous and other societies in 1834, the ratio of increase of the powers of working, is shewn by the following statements:—

	Antient societies, or individuals.			Societies after 1834, called Anonyme.		
	No. of mines.	Working pits.	Tons.	No. of mines.	Working pits.	Ton.
1834	224 Concessions.	249	1,543,697	83 Concessions.	92	899,871
1835		252	1,643,088		100	1,004,291
1836		318	1,807,538		153	1,244,625
1837		345	1,917,486		210	1,311,311
1838		389	1,974,844		271	1,285,427

Essays upon the subject of Accidents in the Mines.

In the year 1840, the King of Belgium, under the recommendation of Mons. Northornt, minister of public works, added the sum of 2000 francs to the rewards given by the royal academy of Brussels, for the *best essay* upon explosions in mines, and the means of preventing them. In consequence of this invitation, fourteen memoirs were presented, five of which, were considered entitled to rewards, viz., those of Mons. A. H. M. Boisse, M. J. Gonot, M. Gustave Bischof, M. Th. Lamielle, and Mons. M. Motte.

In all these essays, great talent and ingenuity, as well as practical detail will be found; and it is a matter of regret, that under the limits of my present work I cannot render more ample justice to the researches and the valuable facts therein recorded. I beg, also, to express my great regret, that during my late hurried visit, I was not favoured with an introduction to any of the above-named gentlemen.

The subject of the safety lamp has also received the most minute attention, which terminated in the invention of a lamp, composed partly of glass, and partly of wire gauze, by Mons. Mueseler, which, in Belgium, is preferred to that of Sir H. Davy, and is constructed as follows:—

A cylinder of fine glass, half an inch thick, surrounds the light, and is fitted closely down upon the oil lamp. This cylinder is in length about three inches, and is surmounted by a cylinder of wire gauze.

A conical wire gauze chimney also commences from a little above the flame of the lamp, and terminates towards the top of the wire gauze cylinder. An open brass shield sits loosely round the glass, to guard it from accidents.

The light from this lamp is considerably greater than from the Davy. The flame is fed with air *descending* from the wire gauze above, and has the advantage of being defended from the current of air in travelling; so that in point of convenience and light, it is certainly superior to the lamp of Sir H. Davy. But it cannot be denied that glass, however strong and well defended, always carries with it an objection in point of safety, owing to the continual chance of strokes, or breakage, by the falls of the roof; and it is also questionable, how far it may not be liable to fly when hot, and coming into contact with water. Suffice it to say, that it is a handsome and ingenious piece of mechanism; and notwithstanding special objections may be urged, it must also be admitted an improvement for the making of surveys, and other general purposes.

In examing the essays of the intelligent gentlemen before mentioned, I feel a necessity for confining my observations to a few of the most remarkable and practical experiments relative to their mode of effecting ventilation, and which will afford my professional countrymen an opportunity of comparing the results of the practice in Belgium with that of England.

The essay of Mons. A. M. Boisse commences by stating the nature of the inflammable air met with in the Belgian mines which consists of

Hydrogen gas - - -	4
Carbonic acid gas - -	1
	5

That the ventilating current should possess a speed of ·60 metres per second; and he quotes the authority of Mr. Combes, who has written elaborately upon the subject, "that the worst ventilated mines possessed a current equal to 1·70 cubic metres per second. In the mines of Hainault, 7½ cubic metres, where the current was acted upon by a ventilating machine, and 3½ cubic metres where an ordinary furnace was employed."—

In the most extensive mine which he had visited, the current consisted of 8 cubic metres per second, and the current was subdivided into five branches, all of which were united before ascending the upcast pit. The greatest speed he ever saw, was 1·20 metres per second. When the speed is 1·50, it will extinguish naked lamps.

"Taking the volume at 8 cubic metres per second, and the speed ·60, it will require a gallery equal to 13½ square metres, equal about 3·70 high, and a similar width."

The air courses are generally 4 square metres area, but frequently much less; the volume of air which circulates, does not ordinarily exceed 0.60 × 4 equal 2·40 cubic metres per second.

The quantum of 2·40 cubic metres is insufficient for mines when extended, but especially for fiery mines. Seven cubic metres × ·60, would require a gallery of 11·66 square metres; and if the current be divided into two, it will give 3·5; if three, 2·33 cubic feet, per second.

In many cases, no artificial means are used to propel the ventilating current; sometimes a water-fall is employed, and also air pumps; generally lamps or furnaces of various descriptions; but the centrifugal ventilating machine is held in the highest repute, and is constructed as follows:—

The top of the upcast pit for 8 yards in depth, and 20 feet diameter, is formed into a perfect cylinder, into which is introduced an axis 20 feet long, whereon is affixed a spiral, fitted closely into the said smoothened shaft, and a steam engine applied to communicate centrifugal motion, which has the effect of discharging the upcast air, with a speed proportionate to the size and velocity of the machine. The revolutions of the said axis are generally 300 per minute.

They sometimes employ a portable machine of this description, capable of producing a volume of one-half a cubic metre per second; it is worked by one or two men—its diameter should be 0·334 metres, and it should make 28 revolutions per second; the spiral shaft should be 3 or 4 metres in length, furnished with an iron spiral, and the air course to which it is applied, must of necessity be enclosed.

At the mine, "Sacré Madame," a pair of air pumps are used. Each cylinder is 2·025 metres in diameter. The pistons have 1·72 of stroke, and are worked by a steam engine of ten horse-power; each piston making 26 strokes per minute, exhausting 145 cubic metres per minute.

A similar machine is used at St. Leonard, upon the Sambre. Dimensions, as follow:—

	Metres.
One cylinder, diameter - -	2·595 continuous.
Stroke of piston - - - -	2·16
Number of strokes per minute -	21

This machine extracts 239 cubic metres of air per minute, and is worked by a steam engine of 20 horse-power.

The first air pump was erected in 1830, in the district of Mons, at the Pit St. Louis, in the concession of Grieseuil. The most powerful is that of l'Esperance, near to Seraing, which extracts 8 cubic metres of air per second.

Where the mines are safe, the furnaces may be placed at the bottom of the pits; but in fiery pits they ought to be fed with air brought directly from the surface, or by a current uncontaminated by gas; but in such cases, the furnace should be guarded by a wire gauze, or by long and narrow tubes, upon the capillary principle discovered by Sir H. Davy.

It has often been proposed to heat the ascending air by means of steam, discharged from the boiler of a high pressure engine; but it has not been carried out upon any large scale.

In the coal mines near Valenciennes, the furnace air is taken down the ladder pits, and the quantity necessary for the furnace, is regulated by double doors; the hot air escaping by the main pit, at 15 or 20 yards distance. "*In the Newcastle mines they employ different means, but not so sure; supplying the furnace with the purest air, and conducting the adulterated air into the shaft, by another opening.*"

The furnace of Mr. Cockerill, Seraing, consists of a tube 8 metres high, and 1·20 diameter, lined inside with a layer of brick, and fitted in a staple, near to the upcast shaft. This tube communicates with the upcast pit by means of two openings—one of the openings, situated near the fire, serves for the ingress of the vitiated air, which, after having circulated between the sides of the staple and the exterior of the tube, returns into the chimney shaft by the upper opening. A pipe carries off the smoke of the fire tube into the atmosphere; which pipe is furnished with a register to regulate the draft, and the fire itself is fed with fresh air.

Mons. Gonot, another eminent engineer, has also performed a great many experiments relative to the principles of ventilation. He states the specific gravity of gases in the Belgian mines to be as follows:—

Atmosphere.		Sp. gravity.	Carburrated Hydrogen.		Sp. gravity.
Oxygen	79		Hydrogen	75·17	
Azote	21		Oxygen	24·83	
	100	1		100·00	0·555

Carbonic Acid Gas.			Steam.		
Carbon	27·36		Oxygen	88·90	
Oxygen	72 64		Hydrogen	11·10	
	100·00	1·524		100·00	0·620

	Specific Gravity.	Weight of a Litre = 1·76 pint.
Atmospheric air	1·	1·2991
Oxygen	1·11056	1·4337
Azote	0·9691	1·2590
Hydrogen	0·0688	0·0894
Carbonic acid	1·5245	1·9741
Carbur. Hydrogen	0·555	0·7270

Mons. Gonot published a course of experiments made from 45 different hypotheses, the result of which leads him to the following conclusions:—

1. *Temperature*—The *increased* temperature of the upcast to that of the downcast air in most of cases was 20 deg.; in some instances it was 35; and in one particular case it was 60 deg.; the furnace being placed in the upper part of the shaft, the depths ranging from 200 to 300 metres.*

2. The length of air course averaged about 2000 metres per single column.

3. The mean section of air course 2·80 by 1·90 equal 5⅓ square metres.

4. Mean speed of column 1·3 per second, the greatest speed 1·54, with an air course 14 by 4·2 equal 17·96 cubic metres per second. The least *volume* was 1½, and the greatest was 20 cubic metres per second, the average ranging from 8 to 15 cubic metres per second. At the greatest speed, the interior current was several times subdivided; and it is a very proper arrangement in the Belgian collieries to enlarge the main outlet, embracing the junction of all the columns equal to the upcast shaft. From amongst a great number of details I select the following, for the purpose of shewing how scientifically the principles of ventilation were, under these encouragements of the government, gone into and elucidated, viz.:—

Mons. Gonot first lays down certain practical data, and then reasons and calculates the results of certain alterations, founded upon acknowledged or ascertained principles. He thus developes his first principle.

20. "I have supposed two pits, one downcast and the other upcast, each 200 met. in depth, and 6 met. in area (= 7½ feet diam.), and that the *bouveau* (enlarged and outlet passage) was 300 met. in length, and 4 in area, which is the real state of our mines, and may be said to be nearly a maximum; that the current is not divided, and that the air galleries were two square metres area, and 1,000 metres in length. With these data the volume of air would be 3·94 cubic metre per second."

21. I have assigned to the pits 8 metres area (8½ feet diam.), the other data remaining the same, the volume of air will be increased 0·68 cubic metre per second.

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* As he takes the temperature of the air at top of the upcast pit, it is of course influenced by the degree of heat from the furnace below.

22. The two pits having the same area, viz. 8 metres, but with a *bouveau* increased to 6 square metres, and the principal current to be divided into two branches, the length of air course being the same; the augmentation of air in this case will be 2·46 cubic metres per second.

23. General circumstances the same, but with two *bouveaus*, the one for coal road, and the other for air course, the current not to be divided, and the area of the gallery to be reduced from 2 to 1 square metre; in consequence of these three changes, the volume of air has been diminished 2·63 cubic metres per second.

24. In giving the air course an area of 2 metres, the current has been increased 0·73 metre per second.

25. The current is divided into two branches in the coal, which doubles the area, and gives an addition of 1·51 cubic metre.

26. The current is divided into three branches, and the air is augmented 1·58 cubic metre.

Cubic metre.

27. The current divided into 4 branches, augmentation 1·69
28. Ditto 6 do. do. 3·44
29. Ditto 8 do. do. 3·66

30. The air is conducted through eight boards, with two working pits of 8 metres area each; the increase is 1·52 cubic metre.

31. The air supplied by three pits, of the same area, the increase will be 1·56 cubic metre above No. 30; and by the successive alterations 16·19 cubic metres above No. 20.

32. The length of the galleries being doubled, viz. from 1000 to 2000 metres, and forming a total air course of 17,000 metres, nearly 10½ miles, if the current of air be not divided, the supply will only be reduced 2·17 cubic metres.

33. In a case in which the air has only one descending pit, the current undivided, and its whole course only 9000 metres, this change occasions a reduction of 14·75 cubic metres.

34. Temperature of upcast air 100; fire placed at 40 metres in depth; 2 pits, of 300 metres each; the descending pit, 6 square metres area; the upcast pit 3 square metres area; gallery

2 square metres area, and 2000 metres long; current undivided, speed 0·83 metres, gave 2·15 cubic metres per second.

35. General circumstances the same, but air only heated up to 50; speed 53, volume only 1·37 cubic metre.

36. The two pits, of 8 square metres area, each taken directly at bottom of pit, speed 3·06 metres per second, volume 24·48 cubic metres per second.

38. The two pits are communicated by a gallery 4000 metre long, and 1 metre area, speed 0·619 metre; gallery too small, consequently only ·072 per second.

Conclusions.

1. When the pits and the air course, in which all the columns unite, are of a greater area than that of all the galleries travelled by the branch currents, the air, instead of being diminished by division, is augmented.

2. When the galleries are very long, and of an area smaller than that of the pits, the resistance on approaching to the pits is not so material, because the speed there is very little. It then mostly depends upon the galleries to produce the speed of the air; and whether it be interrupted generally, or in part, it is all the same. The forcing of air up and down the individual workings is injurious, inasmuch as it elongates the current, and affects the ventilation of the whole mine. Doors should be provided, to direct the current into the necessary working places, and not leave the hydrogen gas to accumulate in the upper parts of the workings, from which it cannot afterwards be dislodged without great trouble.

3. If the air be not divided, the galleries will require to be as spacious, at least, as the areas of the shafts.

4. The fresh air should be, if possible, conveyed to each set of workings, and should be carefully arranged so as to pass from the dip to the rise, more effectually to carry off the fire-damp on account of its lightness.

5. To give, above every thing, to the pits and principal galleries where the air is not divided, large dimensions, in order to

diminish friction as much as possible; and for the same reason, to divide the currents the better, to direct fresh air into the respective working places.

6. And lastly, to take such precautions as may hinder the air charged with fire damp from passing into other working places, or of coming in contact with the ventilating furnace, or with the naked flame of the safety lamp.

M. Gonot thus concludes, "I am satisfied that if persons would only apply these principles to ventilating the coal mines in Belgium, it would render explosions almost impossible."

Remarks.—The volume of air resulting from these several statements, then, varies from 3 cubic metres per second to 20, and taking the mean volume of the improved air courses by means of several divisions, at 15 cubic metres per second, is equal to 24,500 cubic feet per minute, which is very inferior to the well ventilated pits in England; especially when the excessive proportion of shafts in Belgium is taken into consideration, together with the limited extent of the air courses, which scarcely ever exceed 2,000 metres in length, the speed of the air being about 4 feet per second.

The annexed table is founded upon the temperature of the upcast air being 20 deg. higher than the downcast; depth of shafts 200 metres, and two separate pits for ventilation, with air course from 1700 to 2000 metres in length.

Table, shewing the result of various Combinations for producing Ventilation, per Mons. Gonot.

No. of Cases.	Height of Hot Column Met.	Number, Length, Section, and Cube. Pits.	Number, Length, Section, and Cube. Galleries.	Length of Air Course. Metres.	Total Cube of Pits and Galleries Metres.	Mean Section. Metres.	Mean Diam. of Pits. Metres.	Mean Speed ℔ Second Metres.	Volume ℔ Second. Cu. Met.
1	200	2 × 200 × 4 = 1600	1 × 300 × 4 = 1200	1700	4800	2·82	1·90	1·15	3·24
6	200		1 × 1000 × 2 = 2000	..	..	..	..	1·51	4·26
12	40		3200	..	..	..	..	0·51	1·44
18	300		1600	..	..	..	..	1·40	3·95
			4800						
21	200	2 × 200 × 8 = 3200	1 × 300 × 4 = 1200 1 × 1000 × 2 = 2000 3200 6400	1700	6400	3·76	2·19	1·23	4·62
25	200	3200	2 × 300 × 6 = 3600 2 × 1000 × 2 = 4000	2000	10800	5·40	2·62	1.23	6·69
29	200	3200	2 × 300 × 6 = 3600 8 × 1000 × 2 = 16000	2000	22800	11·40	3·81	1·49	17·05
34	40	1 × 300 × 3 = 900 1 × 300 × 6 = 1800	1 × 2000 × 2 = 4000	2600	6700	2·58	1·81	0·83	2·15
40	200	1 × 200 × 8 = 1600	1 × 10 × 1 = 10	200	1610	7·66	3·12	4·17 0·52	31·99 3·99
45	200	2 × 200 × 8 = 3200	1 × 2000 × 8 = 16000	2400	19200	8·	3·19	1·24	9·98

Working of the Mines.

I was very anxious to ascertain, by actual inspection, the manner in which the working of the collieries was conducted; I therefore made it my business to visit some of the principal collieries in the neighbourhood of Jemappe, viz., Produit and Grand Hornu, where the pits are from 160 to 190 fathoms in depth, and of which fifteen of the upper seams have been more or less worked.

In consequence of successive accidents happening to persons descending and ascending the shafts in tubs, the government enacted, that every colliery should possess a separate pit or pits, in which ladders (in many cases perpendicular) should be affixed, and by which means every person employed in the mine was obliged to pass and repass; notwithstanding which I was favoured with the use of the *cuffat*, used for the conveyance of the coals, the said cuffat being overhung by a sort of wooden canopy, to guard against falling stones. Owing to the disproportionate size of these cuffats (being 8 feet in length, by 3 feet in diameter), they cannot pass each other in the shaft at speed; a recess is therefore formed at meetings, and a man is stationed, who, with a long pole, guides them past; but to accomplish this, they must first be brought to a pause.

Owing to the thinness of the seams, and from other reasons hereafter explained, it is difficult to prosecute the working to any great extent; the practice, therefore, is very prevalent of sinking and drifting from seam to seam, thereby compassing the working of several seams to the same shaft bottom.

The general principle of working may be described as follows:—

A pair of levels are extended, each being 2 yards wide, with an intermediate pillar of 4 yards in width, holed at convenient intervals, for the purpose of ventilation. Out of these levels are turned, at right angles, the main preparatory workings, being 5 feet wide, with pillar between each of 13 or 14 yards; and where the inclination is great, these workings are driven slopewise.

These workings (tailles) are carried on in sets of 8 or 10 each, one set being in advance of another; and as they proceed, the pillars are gradually worked away to within a short distance of the whole coal, constituting a sort of long-wall system, the goaves, or hollows being, in the first place, propped with timber, and afterwards stuffed up with the cuttings of the bottom, the fallen roof, or of the small coal. In driving these preparatory levels, the stone necessarily taken down for the adequate height is, for the most part, drawn to the surface.

The consequence of thus prematurely working away the natural support of the roof under so great a pressure, and with a soft bottom, is to induce a perpetual and destructive movement; to resist which, innumerable hands are employed in the above-mentioned operations, and an enormous quantity of timber necessarily consumed; for not only are the necessary roads under a process of perpetual dilapidation, but the whole coal itself is torn and crushed by the superincumbent pressure. Besides, the stoppings or other applications for the guidance of the current of air through the workings must be under continual injury; and the interior of the workings, in consequence of the want of air, greatly prejudiced.

By the time that the workings have extended 3 or 400 yards from the pit, they are no longer tenable, and the working must either be supplied by a lower seam, or by a new sinking from the surface, hence the vast disproportion of sinkings in this country in comparison with England.

Generally speaking, horses are not much employed in the mines, arising mostly from the above cause, and the tram roads are scarcely ever more than 3 feet in height. The tubs used in the interior of the workings carry 3 cwt. each, and are drawn upon antiquated tramways by females, clothed in jacket and trowsers, and who, on account of the lowness of the roads, drag the tubs by means of a chain, fastened to a belt round the body, and passing between the legs, their position being nearly *upon hands and feet.*

On arriving at the pit bottom, these tubs are emptied into the cuffat, holding from 30 to 35 cwt., in which the coals are drawn up the shaft.

In consequence of the difficulty of keeping an accurate account of the quantity of small tubs brought from each hewer, he is paid by the square metre, measured off every week, an average day's work being 4 or 5 square metres, at about 4d. or 5d. per metre, but he pays for his house and fire at a pretty high rate. This method of ascertaining the amount of the hewers' earnings must be very vague, owing to the great irregularity of the state of the working places. The putters, as well as all other persons, are paid by the day, the numbers required to keep the roads in repair being incalculably great.

Fortunately for the persons interested in those mines which I saw, the coal produces no inflammable gases; for did such prevail, they would not be workable upon the present system.

In the Produit mine, belonging to the Societe de Commerce; the upper 29 seams belong to an ancient company, and the lower 22 seams belong to this company; 63 other seams are known to exist, making in all 114, but to reach which would require, according to their statement, a sinking from the surface of 2000 yards. The extent of this company's concession is from east to west 4000 metres, and from north to south 5000 metres.

The most favourable seams in the colliery are the Carlier, 2½ feet thick, and Grand Franois, 2 feet thick, both of excellent quality, and resting upon soft fire clay. The Produit colliery is at present working only two pits, which at full work can raise out of each pit 180 or 190 tons per day. They commonly work four pits; and three years ago, they wrought six or seven pits, and employed 2152 persons, raising 1000 or 1100 tons per day. In one pit, they could draw 230 or 240 tons per day, from the depth of 347 metres.*

The ordinary diameter of the pits is 9 feet; but they are often formed in an oval shape, and the upper part lined with brick, which, with the constant collision of the tubs, is rendered very unsafe.

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* The power of drawing coals is greatly enhanced, by the pits being relieved from the delay, which would be occasioned by the ascending and descending of the people.

The first stratification that occurs beneath the alluvial, is chalk, differing in thickness from 15 to 160 yards, and containing nodules of flint.

At the Produit colliery I was furnished with a statement of the number of persons actually required to raise 150 or 160 tons per day, out of one of their pits 190 fathoms deep; and which will exhibit, in a striking degree, the disproportionate number of persons employed in raising coal here, compared with an English colliery, similarly circumstanced.

45	Hewers averaging - -	1s. 8d. per day.
32	Drawers - - -	1s. 0d.
10	Overmen and Managers -	1s. 6d.
12	Boys cleaning ways, &c. -	10d.
4	Onsetters at bot. of shaft	1s. 3d.
103		
99	Shifters, Drifters, &c., &c.	
202	Underground.	
47	Above ground—pit heap, machinery, &c.	
249		

Total cost per week, 3000 francs = £125 = about 10s. per week average wages.

It is needful to glance at the proportion of each sort of coals produced under this state of things—out of one of the best seams, viz.:—

		Per Ton of 2,240 lb.		
		s.	d.	
Gayette, large picked -	20 ×	16	10	= 336·8
Gayletterie, second ditto -	18 ×	15	4	= 276
Small - - - - -	62 ×	6	0	= 372
	100			984·8

Equal 9s. 9d. per ton at the canal, minus the expense of leading, 6d. per ton; but even allowing, under the depression of the times, that a deduction should be made of 10 per cent., equal still 9s. per ton on the gross produce. In 1838, they averaged 11s. per ton, gross produce.

I had an opportunity of seeing the operations of the colliery of Grand Hornu, three miles to the westward of Jemappe, in the Hainault district, and said to be upon the most extensive and improved scale in the country. It is about 330 yards deep, and very similar in its arrangements to that of Produit.

The principal pumping engine has a 74 inch cylinder, upon the high pressure principle, with a 7 feet stroke in the cylinder, and 6 feet in the pit, the depth of which is nearly 190 fathoms, and the pumps, ranged in no less than 10 columns, are of 12 inches diameter. Three cylindrical boilers are attached to this huge engine, each 7 feet by 40 feet, with one fire and a single tube each, through which the flame passes. The pressure required for this enormous engine, is only 7 or 8 lbs. per square inch.

A very splendid erection of offices, workmen's houses, a foundry, and engine building establishment, are attached to this colliery, which used formerly to work 6 or 7 pits, and to raise 800 tons per day, employing 2300 or 2400 people, and making very large profits; but a couple of pits are now all that are required.

The colliery was founded about 40 years ago, by a Mons. Degorge, who had to struggle through great difficulties; but at length he lived to reap from it a large fortune. His widow resides upon the premises, which is one of the few extensive collieries in Belgium, carried on by a private family.

It is situated at the bottom of the basin, and has already worked more or less in 15 seams of the Flenu (the highest beds), which is a coal of fine quality, but soft. A good deal of this coal is conveyed to the Parisian market, by means of the spacious canals which intersect the country, and connect it with France. The distance from hence to Paris is about 180 miles, and the cost of transit nearly as much as the value of the coals.

The seams lie at an inclination of about one in nine degrees, and for the most part rest upon a soft fire clay thill, which serves the hewer to curve in. According to the customary mode of conducting their workings, they prefer the thin to the thick seams, inasmuch, as the goaves or hollows are more readily stowed up, and the working of a five or six feet seam would be utterly impracticable under the present system.

I could not discover that they apply any ventilating furnaces at these collieries; but they have a pneumatic spiral ventilator, wrought by a steam engine. I had no opportunity of comparing its results; but I was far from being impressed with the feeling, that it was comparable to the ventilating furnace.

Ordinary working places are two or three yards wide; but owing to the working off the pillars, and the continual state of creep, every thing appeared to me in great confusion, and I particularly remarked the crushed state of the solid coal.

A vast number of persons, mostly women, and an exorbitant quantity of timber are required, to counteract this perpetual and injurious pressure, and the ventilation appeared to me very faint, ineffective, and inadequate to subdue the naturally high temperature; but most fortunately for every one concerned, the coal seems to produce no inflammable gas.

In one of the shafts of this colliery they have 35 fathoms of chalk formation, the lower 20 feet of which contains layers of flint. Between this, and the ordinary coal strata, blue shale, pipe clay, or marl, occurs, 4 or 5 feet thick; and, as this chalk bed generally gives out water in sinking, it is kept back by a wooden tub, constructed as follows:—

The shaft is first formed into 15 or 16 sides, by means of straight timbers 20 inches long, and 6 or 8 inches square, placed horizontally. These pieces are so jointed, as to abut against each other, and being built upon a water tight stratum in the shaft, they are thoroughly wedged in both at the joints and behind; and this tub, when well executed, will stop water under a pressure of many fathoms.

The colliers use nothing but linen and cotton clothing, which must be attended with grievous consequences, in case of fire.

In fiery collieries, they frequently advert to the ventilating furnace; but on account of the accumulated inflammable air in the goaves, and the contiguity to the upcast pits, they dare not apply it in the ordinary way; they, therefore, provide a recess towards the upper part of the shaft, in which the furnace is placed, and which is fed with fresh air, brought from the surface, by means of a brattice or adjoining pit.

I had not an opportunity of seeing the district of Valenciennes, across the French frontier; but was told that some of their coal pits are 620 metres in depth, and that the workmen are not allowed any other means of ascending or descending, than by ladders.

The mode of managing the coals aboveground is very inferior to the method practiced in England. The cuffat tub, 7½ feet by 3 feet, and containing 30 cwt. of coals, is *upended* by a chain and winch upon a platform, where the coals are shovelled, and hacked, and cleaned, under a very heavy breakage. A few wide horizontal bars are fixed upon the said platform, over which they are raked by numerous females, into either waggons or oblong baskets placed across a sort of rolley, by which they convey them to the canal; these baskets contain 5 or 6 cwt. each. The small coal is then barrowed up into large heaps, until the time of sale arrives; and the large coals are selected by hand, into the two denominations of Gayettes and Gayletteries.

Geological Structure.

I must now bring under the reader's especial observation, one peculiarity which belongs to this coal field, compared with any coal field in Great Britain, viz.:—That the western district round Jemappe, is overlaid for a very considerable extent with chalk, as before mentioned, which in many cases has been proved to the depth of 400 feet. In the first place, then, the bottom of the coal basin, which is situated in the neighbourhood of Hornu, and which has its natural north and south rise towards each respective outcrop, also dips, in a gentle manner, towards the west, and along with it the chalk continues to thicken until it exhibits itself in the cliffs, upon the coasts of France and Belgium; and there is no reason to doubt, that it is a continuation of this chalk which again presents itself to view in the cliffs of Dover, and until its *debris* appears to the northward of the metropolis; these facts, then, bring prominently into consideration, whether or not the carboniferous strata of Belgium exist under the chalk formation of England.

Remarks.

The Editor of "Fossil Fuel," in his description of the various English coal fields, states, "The South Gloucestershire, or Bristol field, lies to the east of the city of Bath, and may be said to be a dozen miles in length, extending from the Avon northward, and three miles in average width." "This is the nearest place to London at which coal has been found, and here the strata dipping eastward pass beneath the red marl." Assuming then that the Somersetshire coal measures continue to dip at the rate they do at Bristol, they will ultimately pass under the metropolis, where wells have been sunk to the depth of 130 feet before reaching the sand; and Mr. Phillips (in his Geology, page 219,) supposes that "the strata of coal are more than two miles beneath the bottom of the clay underlying London."

The distance from the eastern part of the Somersetshire coal field to London is 100 miles, and the distance from the most western Belgian colliery to Dover is a similar distance, affording good grounds for confirming the above-mentioned theory of Professor Phillips.

Of course, any conclusion of this nature, comprehending as it does so vast a space, must be liable to considerable doubt, more especially as, according to the established theory of geologists, numerous series of intermediate strata occur between the coal fields of England and the London chalk. At the same time, the fact seems comparable to the similar circumstance of the magnesian limestone, which overlies the carboniferous strata of the county of Durham; and as such deserves the attention of those learned theorists who have done so much to investigate the science of geology. I am not acquainted with the Somersetshire coal field; but

I never saw a coal field in England similar to that in Belgium, as containing such a vast succession of coal beds, with so small a proportion of thick coal. Again, the quality of the Flenu coal is unlike any thing in England, but very similar to that of Swansea, viz. a species of conglomerate, without hardness, or without those facings which characterise the coking coal of this country. The most similar coal in this district, is that derived from the new collieries on the Wear to the westward of Durham, which resembles in some degree the Belgian, in containing a very unusual proportion of carbon, being peculiarly free from sulphur, and consequently excellent for coke, gas, and the manufacture of iron.

Notwithstanding the great and laudable pains taken by the government in the education of mining engineers, and the literary and scientific acquirements exhibited by many of them in the publication of the different essays on the prevention of accidents in the mines, I am free to confess, that the result of my observations is, that a great deficiency exists in respect to safe and economical measures for carrying on these coal mines, especially in the deep mines which I saw. Having said thus much, it is only proper to enumerate some of the particulars upon which I have come to this conclusion, and in what respect the measures are inferior to the process of working the mines in England, viz. :—

1. By an ordinance of the government, the work people are all constrained to ascend and descend even the deepest mines by means of ladders, not only greatly enhancing labour but endangering life.

2. The shafts and drawing apparatus, at least in the districts I visited, partake of none of the improvements now extant in the north of England, which give facility to production of quantity.

3. The workings underground are not carried on with adequately strong pillars, either for suitably defending the roads, or for carrying on the workings to a sufficient extent for the saving of sinking expenses.

4. From the like cause, a perpetual compression is induced, not only upon the pillars, but upon the face of the whole coal,

so as to damage and crush into small coal an unnecessarily large proportion of the mine.

5. From a want of sufficient arrangements for horses, the workings in each seam are confined greatly to manual labour, and, consequently, are stopped at distances unnecessarily limited.

6. Under circumstances, proper air courses cannot be maintained, to provide for, and carry off the constantly accumulating masses of carbonic acid, or carburetted hydrogen gas, as the case may be, so that it becomes impracticable to adopt the ventilating furnace upon a similar principle with those used in the north of England.

7. Moreover, from the mode in which the works are laid out, I conceive that it is impossible, advantageously, to apply the respective labourers; and I am fortified in this opinion, by the statement of the number of persons, of every denomination, employed for the raising a certain number of tons, which I feel satisfied is very little short of double the number that the same quantity of tons would require under the system which prevails in the north of England.

8. The arrangements for separating and dealing with the coals, after being brought up the shaft, are also greatly inferior to the most ordinary mechanical process in this country; and, therefore, taken altogether, I submit that the following results happen:—

First. The mode of working causes a serious and unnecessary expense to the proprietor, thereby disabling him from keeping his place in the public competition of nations.

Secondly. The process is detrimental in a national point of view, inasmuch as it causes a considerable portion of the mine to be lost, and reduces the amount value of the remainder, by converting it into small coal instead of large.

Thirdly. The system presents many difficulties in respect to the ventilation of mines, and to the preservation of the lives and limbs of the people.

I have been induced to go more into detail upon these matters since I perused an extract from a report, lately made by the engineer in chief of the mines of the Borinage and of the basin of Charleroy, Mons. Briavionne, in which he predicts, that at the end of 20 years, the coal mines of western Belgium will have arrived at the last stage of profitable working. He says, " That the mean deepening of the pits has of late years progressed at the rate of 15 metres per annum, and at the present moment the works have attained a mean depth of 247 metres (134 fathoms) in the district west of Mons, and 147 (80 fathoms) in those of the centre and of Charleroy."

" Supposing that these workings be so equalised as to reach altogether to the depth which they would seem not destined to exceed, that is 500 metres (= 268 fathoms), they would, before 20 years, have arrived at this stage every where; and the coal (assuming it to exist in abundance beyond this limit) would be so costly and difficult of extraction, and so expensive, as to take it out of the reach of the common uses of this day."

" The attention of the Belgian government has been called to it, and to the formation of the new grants, so as to prevent as much as may be unnecessary waste and improvidence."

This announcement comes with appalling force upon the numerous joint stock companies, which were established in 1836–7, when people thought themselves fortunate if they could only obtain a share in these concerns, at ever so exorbitant a rate.

According to Mons. Briavionne, in his work de l'Industrie en Belgique, we find that three-fourths of the total quantity are raised in the three basins around Mons, the centre, and Charleroy, the remaining quarter in Liege and Limburgh.

The capital of the different companies is stated at 40,540,000 francs, from 1833 to 1838 inclusive, = £1,620,600.

		Tons.
In 1838,	There were raised - -	4,000,000
	Exported to France -	734,262

		Francs.
1839	Value of coal exported -	11,347,000
1841	Ditto - -	15,227,900
1842	Ditto -	15,220,300

According to the above quoted report, Belgium is travelling towards a momentous crisis; and I am much inclined to confirm the writer's opinion, that according to the present plan of carrying on the collieries, notwithstanding the high price received for the coals, yet that coal will not be found workable to profit below the depth of 250 or 260 fathoms; inasmuch, as the deeper they go, the more destructive and unmanageable will be the effects of the pressure. If, on the contrary, the collieries were laid out with spacious pits, good and safe machinery for changing the people, and for raising the coals, good horse roads underground, with a suitable, strong, and provident principle of working, capacious air courses, and well constructed ventilating furnaces, accompanied with proper and mechanical means of handling the coals above ground, all laid out upon a scale commensurate with the grand object of attaining the still lower seams; then am I of opinion, that the continuation of profitable working will be attainable at depths considerably beyond the limit of Mons. Briavionne, to be terminated chiefly by the temperature, which, according to ascertained facts, will increase in proportion to the depth. An additional reason for the above opinion is, that the price of coals will not only be maintained, but have a tendency to be enhanced, in proportion as the adventures become more costly and precarious.

Provision for Sufferers in Cases of Accidents.

In 1842, the minister of public works, Mons. Vischers, gave a report upon this subject, founded upon the numerous accidents which stand recorded in this book, page 172. In this report, he first recites the legislative acts which had taken place from time to time upon the subject, and describes the progressive enlargement of the trade, as before detailed, viz.:—

"In 1803, 4, and 5, the trade received its first great impulse during the sojourn of the French armies at Boulogne. In 1815, a grand movement was caused by the opening of the Mons canal to Condé, and afterwards the finishing of the canal of Antoing. The export to Holland was also highly advantageous to the province of Liege, during the 15 years of the union. The separation of the two countries in 1830, caused a great injury to the trade; but new vigour succeeded during the year 1834 and the three following years, similar to those of 1804–5. The proprietors of mines in the department of Jemappe, having calculated upon a permanent increase to the consumption, opened a great number of pits. Collieries were bought and sold at enormous prices, great winnings were projected, and the condition of the working miner was improved."

It was about the year 1834, that the creation of relief funds took place in the neighbourhood of Mons—one eleventh of the miners' earnings were reserved for the subsistance of the lamed and injured by fire. Some legislation upon the subject had taken place in 1812; but the entrance of the Allied armies, in 1815, put an end to the arrangements.

In 1839 and 1840, certain previous reports of Mons. Vischers were submitted to the legislature, and acts were passed for the regulation of funds and payments, in case of accidents.

The report then recites the various regulations existing in Germany, for the support of miners or their families, in cases of accident, the particulars of which, it is unnecessary to reprint here; as also the existing associations in France and Great Britain.

The term of these associations round Liege and Namur, is for a period of 5 years; those of Hainault, for 10 years; it being supposed, that these protracted periods tend to consolidate those useful institutions.

The resources of the society consist of—

1. Stoppages from the earnings of the workmen, = one-half per cent.
2. Allowances from the employers, equal to that of the workmen.
3. Subsidies from government.
4. Donations and especial grants.

In 1840, the government granted 42,000 francs, and in 1841, a similar sum.

The societies of Mons and Charleroy are only one year old, and that of the centre was instituted 10th October, 1841, at which period the state of the association will be seen by the following table:—

		No. of Mines.		No. of Workmen belonging thereto.		
		Asso.	Not Asso.	Asso.	Not Asso.	Total.
1. Hainault.	Mons	36	16	12118	2502	14620
	Charleroy	42	29	6360	993	7353
	Centre	12	—	3662	—	3662
2. Namur & Luxemburgh		33	27	878	987	1865
3. Liege		63	46	8389	2613	11002
		186	118	31407	7095	38502

Regulations by Royal Ordinance of 30th Sept., 1841.

Articles 1 and 2. Introductory.

3. The resources of the society as above.

4. Every colliery to contribute annually to the society a sum equivalent to one per cent. of wages paid to the workmen, one half of which to be repaid by them.

5. In order to provide against unlooked for accidents, a sinking fund to be provided at 10 per cent. upon the above. The majority to have the disposal of this fund.

6. A secretary to be appointed residing near to each society.

Management.

7. The committee to consist of 10 members.

8. The governor of the province to be president, and the chief engineer of mines to be a member of the committee, with power to preside.

9. Five of the committee to be chosen from the proprietors, and three from the workmen, to form the committee of 10, and to remain in office a quarter of a year.

10. Vice president, treasurer, and secretary to be fixed by the committee.

11 to 14. Customary rules for carrying the object into effect.

Relief.

15, 16, 17, and 18. Ordinary payments to consist of temporary relief, or allowance for life.

Pensions for life are allowed under the following circumstances:—

1. When a workmen becomes incapable of working.
2. To the wives of workmen who have lost their lives by accident.
3. To the father or mother, grandfather or grandmother of such workmen as have lost their lives by accident, they having no other mode of subsistence.
4. To workmen who have worked not less than three years in an associated work, and who cannot maintain themselves.

Temporary pensions.

1. To children, whose parent may have perished by accident.
2. To orphans, whose father or mother, last surviving, has perished by accident.
3. To young brothers or sisters of a workman, who has perished by accident, provided they depended upon him for subsistence.

20, 21, and 22. Every survivor who may marry or live in concubinage, or who may have been condemned to more than six months' imprisonment for any offence, forfeits the pension.

23. In case of death, from whatever cause, the survivor having children of tender age, the pension may be increased at discretion.

25. No pension allowed to persons bringing disease upon themselves, or to the survivors of persons committing suicide.

26. Pensions take date from the day when they are fixed by the committee.

In the interval, subsistence to be given by the committee, or by the mine proprietor, the period not exceeding six months.

27. In no case can the funds be bestowed upon persons not in the association.

28, 29, and 30. Ordinary rules regarding payment of allowances, &c.

31. Part of the funds to be disposable for education, the admittance, being gratuitous, to the children of the associated colliers.

General meetings.

32. Yearly meetings, at which to appoint committees, &c.

33. Every member to have a vote.

34 and 35. Rules may be altered, by giving 14 days' notice in the newspapers of the province; such changes to be voted by three-fourths of the members present, provided that number represents more than half the whole association; such altered rules requiring the royal assent.

GENERAL VIEW OF THE COAL TRADE

SINCE THE YEAR 1836.

HAVING in the foregoing pages given a general view of the state of our own coal mining, and having also recorded a variety of facts belonging to that of other countries, I again advert to the trade of this northern district, with the intention of reviewing its principal operations, subsequent to the last parliamentary enquiry in 1836; in doing which I must entreat the favourable consideration of my readers, and particularly that portion of them who claim an especial knowledge of the subject. I am not so sanguine as to expect that I shall escape criticism; but let it be borne in mind that the undertaking is replete with difficulties.

The engineering section of the work embraces what is novel in a mechanical point of view; therefore, the general polity and mercantile position of the trade demand attention in the present section.

Since the year 1836, the successive exploration of new coal fields has proceeded with the greatest vigour; the public railways have continued to open more extensively the western districts of the Wear, the Derwent, the Tyne, and the Tees, and a succession of winnings has been completed in the deep coal districts of South Hetton, Castle Eden, Shotton, Trimdon, Dawdon, and even at Monkwearmouth the consort pit has been sunk to the depth of 184 fathoms, and an inclined plane is being executed 550 fathoms in length, dipping one in six into the seam, the coals to be conveyed up the said plane by means of a steam engine, situated at the surface of the mine. At Warkworth, in Northumberland, a considerable capital is laid out in establishing, upon a splendid scale, the Ratcliffe colliery, upon the property of the Countess of Newburgh, together with an extensive new harbour, at the mouth of the Coquet. At Middlesburgh, upon the Tees, a set of spacious docks have been formed, for the more effectual shipment of coals from the Auckland district; and the capabilities of the Marquis of Londonderry's harbour, at Seaham, have been greatly increased. Before taking leave of this part of the subject, I must not omit to mention the name of the late Christopher Tennant, of Stockton, whose active mind and unwearied perseverance may be said to have originated the Stockton and Darlington, the Clarence, and the Stockton and Hartlepool railways. Always in activity, sometimes for and sometimes against public undertakings, he was for several years in the midst of perpetual parliamentary agitation; his unceasing exertions having been more instrumental than those of any other individual, in laying open the coal districts of the county of Durham.

The consumption of coal having fallen greatly short of expectation, and the railways mainly depending upon that trade, and being placed in active competition with each other, they have almost universally proved profitless. The disproportionate increase of consumption to the inordinate supply of coal has also so reduced the proportionate vend from each colliery, that, generally speaking, the quantities and consequent depressed prices have gradually become inadequate to effect a remunerative trade.

The prices of best coals, which have been made a guide to the supplies, have within the last twelve months given way to an excessive supply; and, in consequence, a great diminution of price has been experienced in consequence of freighting; so that instead of obtaining 30s. 6d. per Newcastle chaldron, the agreed regulating price, they are now only realizing 25s., which is just the standard which Mr. T. Wood, in his evidence before parliament in 1836, said was sufficient to extinguish the inferior collieries, and to supply the trade with best coals. This mode of managing the general interests of the trade has given great dissatisfaction; indeed, so much so, that the regulation may be said to be in jeopardy. Various have been the devices adverted to for silencing the objections of the sufferers, but hitherto without effect.

In the meantime, this lamentable state of things has similarly affected the shipping interest. Unable to purchase the coals, and dispose of them to advantage as heretofore, they have uniformly become the carriers only; but so great has been the competition in that department, that the prices obtained have gradually declined for several years, until at length they have arrived at a status below any profit whatever. In order to illustrate this assertion, I give tho facts, as stated in a pamphlet, by a gentleman well acquainted with the trade, in the year 1839, and I also give the facts of 1841 and 1844, up to the present moment.

Amongst other objects of the speculative mania of 1835, was the formation of shipping companies, in which capital to an enormous amount was involved, the result of which has been almost an universal failure. Not only have their hopes of profit proved visionary, but in many cases the whole of the capital has been lost, and the companies dissolved.

No better fate attended the public coal companies, whose large paid up capitals have been entirely lost, and the shares in many instances given away to those who were willing to become responsible partners.

Much of this state of things is attributable to the times, and much also may be set down to jobbing, and to the general mismanagement which has almost invariably attended joint stock companies.

In 1839, Mr. Robert Anderson, of Westoe, a gentleman highly conversant with the nature of this trade, wrote a pamphlet entitled "The Present State of the Coal Trade." After noticing the inordinate waste by screening, incurred in fitting the coals for market, he remarks "that it is most desirable, as a measure of national economy, that the mines should be worked out with as little waste as possible." He then compares the prices of coal in this district, with those of other districts in Britain, which are as follow :—

NORTH OF ENGLAND.

	Best Coals. Per Ton.		Second Coals. Per Ton.					Third Coals. Per Ton.				
	s.	d.	s.	d.		s.	d.	s.	d.		s.	d.
River Tyne	10	6	8	0	to	9	6	6	6	to	7	6
Wear	11	6	10	0				7	6	to	8	0
Tees	10	9	9	0				8	3			
SCOTLAND.												
St. David's	10	0	7	6								
Charleston	11	0	8	6								
Kincardine, Alloa, & Clackmanan	8	6	6	6								
HUMBER.												
Park Gate	10	0										
Silkstone	12	0										
LIVERPOOL.												
Ornell best coal	14	6										
River best coal	11	0	10	6								
Cannel	20	0										
RIVER DEE.												
Mostyn	8	6	7	6								
South Wales	12	0	10	6				9	6			
Whitehaven	7	6										

Mr. Anderson shews, that the average prices of best North Country coals in London were as follows:—

	1836		1837		1838	
	s.	d.	s.	d.	s.	d.
Newcastle	21	7¼	22	4½	22	7½
Sunderland	22	4½	23	8¾	24	0½

Freights at this period were, 8s. 6d. per ton.

The principal object of the pamphlet was to shew, that under this state of things the ship-owner could not make profit, viz.:—

	s.	d.	s.	d.
That he paid for the Newcastle coals			10	9
City of London dues	1	1		
Newcastle dues, lights, factorage, and expenses in London	1	11½		
			3	0½
			13	9½
Average freight paid in Newcastle			8	10
Average price at market			22	7½

Mr. Anderson gives the details of cost of sailing a vessel with 320 tons of coals, to London and back again, including ballast, provisions, &c., which he makes at - - -	£129	2	8
And freight, 320 tons, at 8s. 10d. - - -	141	6	8
Balance left for wear and tear, capital, &c.	£12	4	0

Charges upon a Cargo of Delavel Wallsend Coals taken to the London Market, in March, 1841.

NEWCASTLE CHARGES.

Chals.	Tons.				
158 =	418½	purchase of coal 7s. 9d. -	£162	4	11

CUSTOM HOUSE CHARGES.

	£.	s.	d.			
Low Lights - - - - -	0	2	7			
Tynemouth - - - - -	0	12	8			
Bridlington and Scarbro' - -	0	7	6			
Ballast Ticket and Town's House, &c.	6	10	9			
Muster Roll - - - - -	1	10	8			
Whitby Pier - - - - -	0	6	4			
Foy 5s., Stamp, &c. - - -	0	9	6			
Night Office - - - - -	0	1	7			
Life Boat - - - - -	0	2	0			
				10	3	7
				£172	8	6
Freight on 408 tons, at 7s. 3d.				£147	18	0
Carried forward - -				£320	6	6

Brought forward - -				£320	6	6

LONDON CHARGES.

	£.	s.	d.			
Night Office, Entry, and Foy -	0	5	0			
Trinity Dues, &c. - - - -	4	18	6			
Tonnage Dues and Entry - -	0	14	0			
City Dues - - - - -	21	18	0			
Metage - - - - - -	5	2	0			
One per cent. tret allowed buyers	3	12	6			
Discount, Scorage, and Expenses	7	1	6			
Note and Receipt Stamps - -	0	18	6			
Commission and Guarantee -	6	17	0			
				51	7	0
				£371	13	6
408 tons sold at from 16s. to 18s. 6d., amounting to - - - - -				£348	16	0
Loss - -				£22	17	6

N.B.—The best coals upon the Wear were, at this time 11s. 6d. per ton on board ship, and were selling in London at 22s. 6d. per ton.

In 1844, the result upon the sailing of the same vessel may be stated as follows:—

To cost of 408 tons of coals at 7s. 3d. -	£147	18	0
Custom House charges - - - - -	10	3	7
	£158	1	7
Freight of 408 tons at 6s. - - -	122	8	0
London Charges, the same - - -	51	7	0
	£331	16	7
By 408 tons sold at 15s. per ton - -	306	0	0
Loss -	£25	16	7

This state of things forms a striking contrast with that of 1809, and during the war.

Mode of Valuing Colliery Property.

The property in coal mines, notwithstanding its seeming uncertainty, is, nevertheless, capable of being managed upon certain understood principles. If unopened or unproved, its value must be necessarily dubious, especially if the prospective period of its being brought into productiveness be uncertain. These various data, therefore, must be calculated, and suitable allowance made, for time and uncertain value in the winding up of the monied consideration.

The rental, then, being once assumed, the value will be the present worth of an annuity during the expected term of its duration, minus the number of years during which it is expected to lie dormant. The rate of return being varied by the valuator, according to certain or uncertain data, and the probable profit to be realised under all the circumstances of the case.

The customary course of valuing the lessor's interest in mining property, in Scotland, has been ten years purchase upon the ordinary rental, unless some prospective increase of value present itself; but in this part of England it is constructed after a more detailed principle.

First, then, the prospective annual value must be assumed, as also its duration; and if it amount to a perpetuity, it will be valued as a freehold; but as this description of property is liable to uncertain or suspended return, a per centage of 8 to 10 per cent. rebate is taken to be equitable.

For instance, a landlord's interest in a coal property, say £500 per annum for 30 years as a perpetuity, is worth at 8 per cent. rebate = 11·25 years purchase, or £562,500.

The lessees' interest is treated in a similar manner, but is subject to still greater uncertainty, inasmuch as it involves the consideration of stock and other expenditure, and even the duration of the lease itself, which might be given up or brought to a termination by policy or by some catastrophe. The first and main consideration is the probable profit to be derived amongst all the varying circumstances of the cost of working, the amount of selling price, the probable yearly quantity to be produced, and the probable expenditure necessary from time to time to keep up the said contemplated quantity. These, therefore, are data, which must *a priori* be assumed, after which the valuation resolves itself into the following principle:—

Assuming the annual yearly profit during the lease to be £1,000, and the unexpired term to be 15 years, then it is an annuity, the purchase value of which, under all the uncertainties of the case, ought to repay a purchaser 14 per cent. per annum, with return of capital equal 6·14 years purchase, or - - - - - -		£6,140
Then taking the colliery stock as valued, in a working state, at - - -	£6,000	
But to be sold off by auction, at the end of the term, including expenses, for -	2,500	
The value of said £2,500 to be received by the purchaser, at end of the term of 15 years, is worth, in ready money, at 5 per cent. discount, ·48 purchase, or - - - - - - -		1,200
Leaving net value - - -		£7,340

The rate of purchase value differs from 12 to 18 per cent., according to the degree of risk and uncertainty of the profits, whether from mine accidents, or the fluctuations of trade; and so great and disastrous have been the fluctuations of this trade during the last 20 years, that with very few exceptions the valuations of collieries in existence, as well as the profits expected from the various coal adventures, have all turned out deceptive and over-rated, from the abovementioned causes.

Prevention of Accidents.

Notwithstanding the extensive use of the Davy lamp, and of the several improvements in the ventilation of collieries, yet explosions had become so numerous and appalling that a committee of the House of Commons sat in 1835, for the purpose of examining into the causes, and of endeavouring to devise suitable remedies. Various safety lamps were exhibited before the said committee, and many viewers, philosophers, and chemists examined; but the affair ended without any parliamentary legislation.

And as a similar routine of explosions is still occurring in every part of the country, various suggestions have been made, and the feeling is now gaining ground that parliament ought to interfere in such matters, in order that the best systems should be enforced throughout the country. It may, therefore, not be irrelevant, on the present occasion, to take a general view of the measures, which are admitted to be the most efficient preventives in fiery collieries, and to contrast them with the general practices elsewhere.

The first and grand principle, then, of safety consists of a plentiful and steady current of air, constantly circulating through all the main passages of the mine.

To effect this, a spacious ventilating furnace is placed within a brick arch contiguous to the bottom of the upcast shaft, which arch ought to be in area from 40 to 50 square feet.

The said current ought to be divided into minor currents, the better to supply the different parts of the mine with fresh atmospheric air, and each current ought to be guided through its various ramifications by brick or stone stoppings, plastered with lime, or otherwise made air-tight.

But in the working of a mine, doors are also requisite, which ought to be as air-tight as possible; and in the main current they should be set in pairs, so as when one is open the other may be shut.

Again, where the coal produces much gas, a minor current of air ought to be forced up to the very working face, by means of thin wooden partitions, frequently, also, requiring partial doors.

Inflammable gas accumulating in the deads, or goaves, ought to be carried off by private passages to the upcast shaft, and not allowed to mix with and adulterate the working air of the mine; and this said adulterated return air, instead of being admitted to come in contact with the fire of the furnace, ought to be conducted into the upcast shaft, by means of a dumb drift or separate passage.

To carry out this principle in an extensive and well ventilated mine, the main current of the downcast shaft is frequently 10 or 15 times subdivided, each column supplying its own independent portion of the mine. The separation is easily effected, and regulated by means of restricting each outlet of air, in proportion to the distance it has to travel, and the portion intended to be assigned to each separate division of the ventilation. A great advantage derived by this dividing system is, that the expansion consequent upon the heated temperature of the mine is avoided, and the air preserved cool and equalised up to its very ascent, consequently more effective.

The overman, or manager of the pit, regulates the use of the candle, or safety lamp; and where lamps are used, they are left in the custody of a person purposely deputed, who both cleans and examines them before they are allowed to be taken into the workings.

These, then, are the main principles of safety as practised in the colliery district of Newcastle-upon-Tyne, accompanied by innumerable details, which it is needless to particularise; and to carry out which effectually, requires both considerable skill and attention, as well as capital; but without which, safety cannot be reasonably calculated upon.

If, with all these precautions, and with this apparent perfection of a system, the result of centuries of dear-bought experience, aided with the most scientific acquirements, safety cannot be ensured, how grievous must be the risks occurring in various mining districts in which these provisions are, for the most part, deficient! For were it not an invidious task, I could specify many collieries which have no artificial means of accelerating the ventilating current, which have no means of carrying off the accumulation of gas from the "deads," other than allowing it ooze into the lazy current of air passing by, and which current is on its course to other workings. As to stoppings, they consist of a few small coals; and in place of substantial doors, perhaps a piece of canvas. The safety lamps are entirely under the care of the ignorant colliers, without either the means or the knowledge of cleaning them, and are put to work in a condition which ought not for a moment to be tolerated. In short, wanting the *main principle of a substantial air column*, skill exercised upon other details would be thrown away; and although the proprietors of great collieries may be gradually impelled to the acquiring and adopting the improved principles already spoken of, it cannot be expected to be made available to a considerable number of smaller collieries, conducted by persons unacquainted with any other than the local customs, and probably too deficient in scientific acquirements, to enable them to see or learn the introduction of better systems. Moreover, many of the proprietors entertain a groundless dread of expense, without forming any estimation of the innumerable advantages which would indirectly result from a good and substantial system of management, in respect not only to the safety of the people, but what is to both the colliery owner, the owner of the royalty, and the nation at large, of paramount interest, viz., that the mines should be worked upon that principle which produces the least waste, both as regards the coal left in unnecessary pillars, and also that stowed underground and burnt at the surface, in the shape of small coal. In the absence of legislative interference, competition has produced excessive stowing underground and screening above, whereby the nominal value of the merchantable coal is enhanced; the lessee, *pro tempore*, having no inherent interest in the duration of the mine, beyond his present lease. Indeed, so long as restriction is not imposed, each colliery owner is obliged to follow the example of his neighbour, in order to keep up his place in the general competition; and the only cure for this waste is, by parliamentary enactments, and a curtailment of the screening to a reasonable extent, compatible with the nature and importance of the mine.

Present State of the Coal Trade and its Prospects.

Having in the preceding pages, and at a greater length than I anticipated, reviewed the rise and progress of the coal trade up to the period of the last parliamentary enquiry, in the year

1836, I now enter upon its present state and prospects, as regards the working population, the mine adventurers, and the nation at large. The grand market for the best coals, and the regulating medium of the trade is in the metropolis, the progressive consumption in which, will appear by the following table :—

Table of the importation of coals into the port of London—

Years.	Ships.	Tons.	Years.	Ships.	Tons.
1832	7,528	2,139,078	1838	9,003	2,581,085
1833	7,077	2,010,409	1839	9,340	2,625,323
1834	7,414	2,078,685	1840	9,132	2,566,899
1835	7,958	2,298,812	1841	10,311	2,909,144
1836	8,162	2,398,352	1842	9,691	2,723,200
1837	8,720	2,626,987	1843	9,593	2,628,520

We have seen, notwithstanding the repetition of evidence from the highest authorities, and the dispiriting return for capital adventured, that not only strangers, but persons reputed as the most experienced in the trade, still continue, up to the present time, to accumulate adventure upon adventure; to add colliery to colliery, until at the present moment nearly the entire district is absorbed in dormant or actual leases. And, although the general object in view may be said to be the same, yet many of the established firms are impelled forward to secure coal fields, the opening of which will give them a claim to increased quantities; and, consequently, tend to lighten their general burthens.

New adventurers are encouraged to commence operations, on account of proximity to some public railway, the proprietors of which will undertake to provide the waggon stock and means of transit; so that instead of the large capitals in the private railways of their competitors, the outlay with them is confined to the establishing of a single shaft and its appendages. Thus matters have progressed, till there are now in the trade, the following formidable list of collieries already established, or about to be established:—

LIST OF COLLIERIES ON THE RIVERS TYNE, BLYTH, WEAR, AND TEES.

Collieries.—Tyne.

Andrew's House.
Backworth.
Benwell.
Blaydon.
Burdon Main.
Burradon and Wideopen.
Charlaw.
Coxlodge.
Cramlington.
Craghead.
Derwent Main.
East Holywell.
Edmondsley.
Elswick.
Farnacres.
Fawdon.
Felling.
Fenham.
Framwellgate Moor.
Gosforth.
Green Croft.
Heaton.
Hebburn.
Heddon Main.
Heworth.
Holywell.
Hotspur.
Jarrow.
Kibblesworth.
Killingworth.
Low Moor.
Lanchester and Medomsley.
Manor Wallsend.
Marley Hill.
Mickley.
Monkseaton.
Mount Moor.
North Elswick.
Oakwellgate.
Oxclose.
Pelaw Main.
Pelton.
Percy Main.
Sacriston.
Seaton Burn.
Seaton Delaval.
Seghill.
Sheriff Hill.
Spital Tongues.
Springwell.
South Tanfield.
South Pelaw.
Saint Lawrence.
Stormont.
Tanfield Lea and Garesfield.
Tanfield Moor.
Team.
Tyne Main and Woodside.
Urpeth.
Waldridge.
Walker.
Walbottle.
Wallsend.
West Townley and Stella.
West Cramlington.
West Stanley.
Willington.
Wylam.

Blyth and Warkworth.

Barrington Main.
Bedlington.
Cowpen.
Hartley.
Netherton.
West Cowpen.

River Wear.

Arbour House.
Beamish.
Belmont.
Cassop.
Cassop Moor.
Castle Eden.
Crow Trees.
Elvet.
Garmondsway Moor.
Haswell.
Hetton.
Hetton South.
Hetton North.
Kepier.
Kelloe.
Lambton.
Lumley.
Monkwearmouth.
Pensher.
Shield Row.
Shincliffe.
South Moor.
Shotton.
Thornley.
Trimdon.
Washington.
Whitwell.
Wingate Grange.

River Tees.

Auckland St. Helen's.
Auckland West.
Black Boy.
Brancepeth.
Byers' Green.
Clarence Hetton.
Coxhoe.
Copy Crooks.
Craggwood.
Deanery Pease's
Deanery Brown's
Eldon.
Etherley.
Evenwood.
Hunwick.
Leasingthorne.
Norwood.
Westerton.
West Hetton.
Whitworth.
Willington.
Witton Park.
Woodhouse Close.

Collieries in progress of winning or re-opening, with probable powers of working when established.

TYNE.

		Thousand Chaldrons.
2	East Tanfield - - -	40
2	Craghead - - -	30
1	Harton - - - -	40
1	Pontop - - - -	20
1	Twizell - - - -	20

BLYTH AND WARKWORTH.

1	Radcliffe - -	30	1	Broom Hill - -	10

RIVER WEAR.

1	Croxdale - -	30	1	Seaham and Seaton	40
1	South Wingate -	30	1	Rainton Grange -	40
1	New Kelloe - -	30			

RIVER TEES.

1	Thirstlington -	30	1	Byers' Green do. -	25
1	Little Chilton -	30	1	Bitchburn - -	25
1	Bishop Middleham	20	1	Woodifield - -	25
1	Whitworth re-opening	25			

The increase of collieries, during the last 44 years, is exhibited by the following table:—

	1800	1830	1836	1844
Tyne collieries - -	29	37	47	70
Wear - - -	8	18	9	28
Tees - - - - -	0	0	16	22
Hartley and Blyth - -	4	4	4	6
	41	59	76	126
Add Radcliffe and others -		-	-	- 4
				130

The following table will shew the rate of increase of this important trade during seven years, ending in 1842; more especially of the oversea trade since the abolition of the duties in 1834; for previous to that time, the duties were in the following ratio:—

3s. 4d. per ton on large coal exported in British ships.
2s. 0d. per ton on small Ditto Ditto.
11s. 0d. per ton on large coal exported in Foreign ships.
4s. 0d. per ton on small Ditto Ditto.

In 1834, the duties were abolished, except 4s. per ton upon coals exported in foreign ships to countries not in reciprocity with this country.

In 1842, a new duty was enacted of 2s. per ton upon all coals exported, which has produced a very baneful effect upon the trade.

Table of coals and coke shipped coastwise, from the collieries in the north of England, as follows :—

	1836	1837	1838	1839	1840	1841	1842
NEWCASTLE.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Coals - - - - -	2,274,768	2,385,192	2,453,225	2,149,814	2,267,082	2,388,139	2,341,071
Cinders - - - -	5,945	7,320	6,503	9,507	14,261	9,838	9,409
	2,280,713	2,392,494	2,459,728	2,159,321	2,281,343	2,397,977	2,350,480
SUNDERLAND.							
Coals - - - - -	971,190	931,944	948,388	913,394	867,777	937,857	859,137
Cinders - - - -	268	191	41	566	451	138	94
	971,458	932,135	948,429	913,960	868,228	937,995	859,231
STOCKTON.							
Coals - - - - -	916,440	1,145,827	1,219,938	1,308,778	1,367,532	1,476,922	1,501,596
Cinders - - - -		10				136	
	916,440	1,145,837	1,219,938	1,308,778	1,367,532	1,477,058	1,501,596
Total - -	4,228,611	4,470,466	4,628,095	4,382,059	4,517,103	4,813,894	4,711,307

Table of coals and coke exported from the collieries in the north of England, as follows:—

	1836	1837	1838	1839	1840	1841	1842
NEWCASTLE.	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.
Coals - - - - -	411,697	471,150	545,972	543,846	583,041	737,456	846,949
Cinders - - - -	4,152	5,007	8,203	14,206	10,870	13,129	19,332
	415,849	476,157	554,175	558,052	593,911	750,585	866,281
SUNDERLAND.							
Coals - - - - -	170,367	242,252	307,828	369,882	442,095	408,191	364,455
Cinders - - - -		211	340	738	892	824	431
	170,367	242,463	308,168	370,620	442,987	408,515	364,886
STOCKTON.							
Coals - - - - -	36,943	46,407	86,535	110,019	131,217	168,731	180,265
Cinders - - - -		109	164	1,688	1,625	614	543
	36,943	46,516	86,699	111,707	132,842	169,345	180,808
Total -	623,159	1,184,136	949,042	1,040,379	1,169,740	1,328,445	1,411,975
Total from preceding page	4,228,611	4,470,466	4,628,095	4,382,059	4,517,103	4,813,894	4,711,307
Making a Grand Total	4,851,770	5,654,602	5,577,137	5,422,438	5,686,843	6,142,339	6,123,282

The total quantity of coals shipped, from the ports of the United Kingdom, in 1842, was—

	Coastwise.	Foreign.
Round coal -	7,284,666	1,828,069
Small coal -		147,211
Coke - -	14,736	23,434
Culm - -	350,067	790
	7,649,469	1,999,504

		Tons.
In 1828 the exportation was	- -	357,864
1832 Ditto	- -	588,448
1835 Ditto	- -	736,060

So disproportionate has been the augmentation of power of production to the demand, that the basis of 1843 only allowed of a real vend of 44 per cent.; or, in other words, a colliery standing upon a basis of 50,000 chaldrons, realized a vend of 22,000 chaldrons; whereas, the basis of 1838 allowed of a vend of 80 per cent., or 40,000 chaldrons.

Hitherto, several of the proprietors of soft coal have found relief in the coking trade; others again have profited by the export of steam coal, especially since the abolition of the duty in 1834; but the avidity with which the former trade is following up, and the serious innovations of South Wales and the continental collieries, added to the re-imposition of the 2s. duty in 1842, threaten most serious results.

When the coasting duties on these coals were repealed, great benefit was expected to take place in extending our sales inwards from the coast; but that expectation has been greatly disappointed.

The extensive ramification of railways, both from the Darlington and all the Midland coal districts, coming into serious competition with the canals, has led to a great and general reduction of the expenses of transit, which reduction has enabled these collieries to push their coals, not only down towards the coasting districts, formerly supplied by this vicinity, but even to the metropolis itself; the inland navigation having conveyed into the port of London, in 1841, 33,594 tons, and in 1842, 31,519 tons.

The effects of inland coals brought towards the metropolis, were thus stated by the deputation of coal-owners, in March, 1844, to the ministry:—

"The following is the nearest approximation to the direct quantities of coals brought into London for transmission through the port," and superseded by the inland coal:—

	Tons.
Thames up stream, beyond Staines - -	100,000
Grand Junction Canal, beyond Lady Capel's wharf - - - - - - -	25,000
Basingstoke Canal and Wey River - -	50,000
Sea and Navigation - - - - -	125,000
Total	300,000

This, then, is the melancholy state to which this great trade has been reduced; and under these circumstances, the government may with great confidence leave it to itself, with respect to checking combination. But it is another question how far they may, or may not, beneficially interfere with the waste of small coal; which subject, has been already brought under the notice of successive parliamentary committees.

With respect to government interference on the subject of accidents incidental to the working of the mines; the parliamentary commissioners shew, that in some parts of the country, measures of safety and precaution are greatly advanced compared to others; and to the want of wholesome measures of safety, may be attributed loss of life in many instances. Now this cannot, by any means, be counteracted, except by parliamentary enactments. I am, therefore, free to acknowledge, that, in my opinion, well digested measures of legislation would not only be beneficial to the owners of mining property of every description, but would also tend, very materially, to save the lives and limbs of the people, as well as to advance their civilization and intellectual attainments.

Although the subject appears now to be forcing itself imperatively upon the public attention, it is far from being new, for in the year 1797, Mr. W. Thomas, of Denton, a colliery viewer of some eminence, submitted a paper upon the subject, to the Newcastle Philosophical Society, having for its object "The establishment of offices in each district, for the registration of plans, sections, and colliery records." And in 1805, it was followed up by a more matured paper, by the late Mr. William Chapman, engineer, who suggested, "That a parliamentary provision of 1d. per chaldron should be enacted for the purpose, calculating the annual vend of the district at a million of chaldrons, which would have raised a revenue of £6250 yearly, and which was to be disposed of in registering plans and records; in giving rewards for information, for the exertions of meritorious individuals in time of accident; in forming a sinking fund, for the support of families bereft of support." Mr. Chapman concluded, by observing "on the necessity of adopting legislative measures, to diminish accidents, and to prolong the duration of coal in the United Kingdom."

In the year 1813, numerous distressing explosions gave birth to the Sunderland Society, "for the prevention of accidents;" and which society, amongst other of their transactions, published a letter from the late Mr. Buddle, embodying explanations of the mode of ventilating collieries, and of dealing with the inflammable air. In this letter, he says "the ordinary and unavoidable casualties in collieries occasion more calamity than explosions from inflammable gas." It has already been observed, that it was to this society that the original safety lamp, of that unwearied and humane individual, the present Dr. Reid Clanny, was exhibited, and whose scientific exertions in the cause of humanity have been in so extraordinary a manner overlooked; whilst his followers, the late Sir H. Davy and Mr. Geo. Stephenson, have been greatly honoured and rewarded.

Amongst the scientific gentlemen who have made the various subjects herein contained the objects of their care and study, I may mention the name of David Boswell Reid, M.D., F.R.S.E., who has lately published an interesting volume, entitled "Illustrations of the Theory and Practice of Ventilation," and who winds up his obsarvations upon coal mines and safety lamps, in the following words :—

" With respect to the 'Davy Lamp' itself, which I have tried in every situation, in the most explosive mines, I may state that I concur with those who consider that it should be materially altered. Placed in a current—especially when the miner is proceeding in an opposite direction—I have seen it again and again blown out; and the force with which the flame may be directed upon the side, or a spark carried through the meshes, especially if any coal dust should have rested on them, may be considered, justly, as very possible causes of occasional explosion.

" On the whole, I may add, that the last modification of the lamp introduced by Dr. Clanny, (who had the merit of constructing a lamp with which the miners entered safely into explosive atmospheres, before any other person in this country had directed any attention to this question,) and in which he has availed himself of the use of the wire gauze introduced by Davy, is the most important I have hitherto seen. Dr. Clanny preserves the flame upright at all times, by a strong cylinder of glass, which enables the flame to give more light than that which can be obtained from the 'safety lamp.' It is defended by a guard, and I have plunged it in water without fracture, after using it for an hour in one of the deepest mines in this country. It was not blown out by a current that rendered the 'Davy Lamp' comparatively useless as a source of light.— The wire gauze above gave it ample protection from fire damp; and caused, from the mode in which the fresh air descends, and the vitiated air escapes, a very singular and interesting series of currents within the lamp itself, well worthy of the most minute and serious investigation, as a question of general interest, independent of their local bearings on this particular lamp. * * * * * * * * * *

" In mines, the introduction of larger supplies of air, shorter air-courses, the use of a lamp on the principles recommended by Dr. Clanny, the education of the miners, and the use of a carbonometer (or some equivalent instrument), appear to constitute the more important points that demand attention."

In 1816, during the discussions before the Royal Society, upon the subject of Mr. Ryan's alleged improvements in the ventilation of collieries, and the difficulty which he complained of having thrown in his way, relative to their introduction, it was observed, "It is much to be regretted that the mines are not under such a regulation that improvements might be made in them, without the projector having to contend with all the local prejudices and objections of persons immediately connected in their working."

In 1839, the report of the South Shields committee on explosions, reiterates their conviction, that without parliamentary legislation, measures of safety cannot be obtained.

In fine, the parliamentary committee, in allusion to the employment of women and children, (in the year 1835,) elicited a mass of evidence, sufficient to convince the most incredulous person, that great and incalculable evils prevail in the prosecution of many of these works, which can be checked by no other means than by parliamentary enactments, not only in respect to explosions, but (according to the facts elicited by the said committee) in innumerable accidents arising from defective machinery, inundations, insufficient timbering, neglected lamps, &c.

In the year 1840, Lord Ashley's motion in the House of Commons obtained a commission which called up the important evidence, which has been published.

Legislation was commenced by the act of parliament of 1842, especially directed towards the amelioration of the condition of young persons, and the exclusion of females from the underground departments of the mines; and it now remains, under all these corroborative proofs, for the legislature of the country, to carry out further measures of individual and national advantages.

Strike of the Pitmen.

The very distressing depression of the trade has been already explained, as bearing heavily upon the interests, not only of the coal-owners, and ship-owners, but also upon the district at large, effecting a diminution of labour and consequent dissatisfaction of the working people—of which class, there is, unfortunately, a great superabundance.

These feelings of dissatisfaction not having been guided by a proper consideration of the real cause of depression, the pitmen have submitted their affairs to the management of individuals (perhaps inadequate) to wield so vast a machine, and have pursued a course which threatens to end in disappointment to themselves, and distress to their families. Acting, therefore, under this questionable policy, they have banded themselves into unions, which they are endeavouring to extend over all the mining districts of the kingdom. They have retained an attorney, W. P. Roberts, at a considerable annual salary, to advocate their interests; and as a preparatory step to the demand for increased wage, they have, for many months, limited the supply of manual labour, with the double view of absorbing the otherwise unnecessary hands, and of exhausting such stocks as may operate against the anticipated advance.

The more effectually to carry out the contemplated object, a general conference was held in the month of March, at Glasgow, of delegates from all parts of England, Scotland, and Wales; and after several days' debate, the motion for a general strike throughout the kingdom was negatived by the representatives, as follows:—

For the strike	23,357
Against do.	28,042
Minority	4,685

But as the delegates from this district represented that their organization was complete, and that the expiry of their yearly bonds on the 5th April, offered the most favourable opportunity for carrying their object, it was agreed that they might suspend work, though the other districts were not to be called upon to contribute towards any expense or maintenance. The miners of Scotland also declined any contribution towards the solicitor.

Consistently, therefore, with the above resolution, a general suspension of work took place throughout this district on the

5th of April. In the mean time, the pitmen, under the guidance of Mr. Roberts, published the terms upon which they were willing to hire themselves; and immediately afterwards, the coal-owners published the terms upon which alone they would engage them. The principal differences between the two parties, consist as follows:—

Pitmen's Bond.

1. To be paid every week close up.
2. Term, for six months.
3. To be guaranteed five days per week, at three shillings per day.
4. Hewers not to be called upon to put.
5. To be paid by weight.
6. Men require to be furnished with particulars of earnings and deductions.
7. Men insist upon the fair day's work being limited to 3s. for 8 hours.
8. Liberty to attend delegate meetings without fine.
9. Owners to have no fly-doors, but all to be furnished with trappers.
10. Men require, in case of accident, to be paid 10s. per week, with medical attendance. In case of death, 5s. per week to the widow or children for 12 months, and that £5 be paid towards the burial.
11. No fine for foul coal, beyond the labour price of the tub.
12. Arbitration clause.
13. Men require, that before being called before a magistrate, they have a week's notice, with specification of the charges intended to be brought.

Owners' Bond.

Pay, once a fortnight, with some running on days.

Term, twelve months, but terminable at a month's notice reciprocally.

No guarantee.

Hewers to put when required, as well as do other work.

The remaining clauses to continue as usual. As the above principles are totally irreconcileable with each other, it follows, that until they are adjusted, all the minor points are out of discussion. In fact, the masters' committee refuse to meet the committee of delegates. The men, are, therefore, thrown back upon their resources, which cannot but be dubious under a hazardous conflict with so influential a body, and under circumstances so greatly against them in regard to the great surplus of pitmen, and the very depressed state of the trade. The consequences are justly appreciated by many of the thinking and industrious miners, who would gladly come to terms upon former principles; but they are overruled by less calculating and more violent persons, who either cannot or will not see the jeopardy in which they are placing the whole cause of the working men, and the certain ruin which a prolonged strike must bring upon a great number of individuals, as well as mischief to the general trade; for the energies of South Wales, Scotland, and the Midland counties will be called into action, to supply those markets hitherto legitimately belonging to this district. Already, indeed, the accumulated stocks of several years are being carried away; whilst up to the period at which this is writing, 8 weeks have passed, during which these deluded men continue to urge their impolitic strife, and to reiterate their determination to enforce their terms upon the coal-owners.

During the progress of the strike, and in order to justify themselves to the public, in resisting the demands of the pitmen, the coal-owners published a statement in the Newcastle Journal of the 4th May, 1844, containing their allegations as to the amount of wages hitherto paid to the respective denominations of colliers; and also the amount of increase which was demanded by them, the result of which statement is shewn as follows:—

	No. of Collieries.	No. of Working People.	Per Cent. Increase demanded.				
			Hewers.	Putters.	Drivers.	Trappers.	Shifters.
Tyne	65	15,556	29·7	24·2	14·5	22·2	15·5
Blyth	4	1,051	18·6	17·9	12·1	20·0	24·2
Wear	31	13,172	29·8	28·4	21·0	20·7	24·8
Tees	24	4,211	24·5	25·6	12·1	21·0	19·3
	124	33,990					

of which 8,607 were employed above ground, and 25,383 below ground.

The average rate of earnings before the restriction was stated to be 3s. 9½d. per day; and, subsequently, 3s. 2d. per day.

In this document was quoted a statement, (some time previously published by a coal-owner,) as an example of the depressed state of the trade, that a certain colliery, the capital of which was £50,000, could only just pay its way, leaving nothing for interest or capital; that it paid £20,000 yearly in wages, and that the present demand of the colliers was 33 per cent. additional, which would amount to £6600 per annum.

Whilst discussing the subject generally, let it not be supposed that I mean to deny that there have been examples of hardship and injustice both on the part of masters and men. That the former have not made reasonable allowance for penalties which ought to have been, nor have the men acted upon their part up to the spirit of the agreement; but individual cases will, under any circumstances, happen, and they form no justification for a general strike. The only affairs which come under general compact are, the agreed ratio of wages, and certain fixed principles of contract, with ample and equitable provisos of settlement in case of difference. But especial circumstances attendant upon particular collieries, must be left to the adjustment of the owners and workmen of such individual colliery.

Present State, and Future Prospects.

With regard to the prospects of the trade, they are, indeed, gloomy and dispiriting to collieries ordinarily circumstanced, inasmuch, as the quantum of vend, under the reduced prices, will not yield a profit.

There was a time, (only a few years ago,) when an opinion very generally prevailed, that relief would be afforded to the trade by an advance of the price of best coals, which would not only have realized to them a positive gain of 4s. per chaldron, but would also have proportionately benefited all other coals, by diminishing freighting, and by tending to realize the otherwise nominal prices; and, although this policy was advocated by many experienced persons, it was successfully resisted by the owners of the prime collieries, who alleged, that by so rendering the trade beneficial, it would induce a still greater influx of adventurers. How far the result of such immense sacrifices has verified the policy, may be questioned, under the fact of the continued increase of new collieries, and the adherence of others to their station, notwithstanding successive and increasing losses. It is said to be now too late to adopt any such measures. Therefore, the only alternatives lie in a continuance of the said unprofitable regulation, or to have recourse to an open trade; the results of which certainly would produce great temporary distress.

I am sorry to be unable to record the progressive details of the trade during the last eight years; but the following statement of the proportionate decrease of actual vend to the assumed basis, will sufficiently attest the growing difficulties which have occurred :—

	Actual Vend per Cent. upon the Basis.		Actual Vend per Cent. upon the Basis.
1835	72·5	1840	55·7
1836	75·2	1841	51·4
1837	80·	1842	49·2
1838	68·1	1843	44·
1839	65·2		

By the above table it will be seen how alarmingly the ratio of actual vend has been gradually diminishing, and is still further threatened by the introduction of twenty additional collieries. Although the succession of unproductive trade has brought some collieries to the resolution of retiring, yet so few are the instances, and so small are the numbers of these collieries, that they promise no material relief.

The competition from various quarters of the country has before been referred to, and especially that of South Wales, abounding as it does in good steam coal, a great proportion of which may be worked level free. It has already become the object of extensive speculation, and from its natural position for continental depôts, is enabled to rival this district in the supply of foreign steam boats, as well as a great portion of the western coasts of England.

The strike of the pitmen, too, has had the effect of again introducing the Scotch coals to the English markets, from which they have been, during past years, virtually excluded by the low selling prices, and the increased cost of transit from the Frith of Forth. But as the advantages of a new market are by this means developed, time contracts have been entered into, and the collieries relieved of their large stocks, to the great detriment of the trade of this district, both at present and in future prospect.

The ramifications of railways through the coal fields of the Midland districts are also, as before remarked, producing a powerful and effectual competition, and are, in a great measure, neutralizing the benefits which we expected to derive from the abolition of the government duties.

Our foreign trade has also received a serious check, by the imposition of the 2s. duty in 1842, which has enabled the coal mines of France, Prussia, and Belgium, to advance their produce much beyond their former limits, and to meet us more effectually in the markets of France, Holland, and the Mediterranean.

The rate of increased produce from the French coal mines, will be seen by the following extract from official documents :—

Year.	Tons.	Year.	Tons.
1825 - -	1,491,400	1833 - -	2,055,297
1826 - -	1,541,000	1834 - -	2,489,800
1827 - -	1,691,100	1835 - -	2,506,400
1828 - -	1,774,100	1836 - -	2,842,000
1829 - -	1,862,700	1837 - -	2,980,700
1830 - -	1,760,400	1838 - -	3,113,300
1831 - -		1839 - -	2,994,900
1832 - -	1,962,905		

Importation of coals into France for a series of years, from the Dictionary of Commerce :—

	From England.	From Belgium.	Total Importation.
1788	184,773	57,818	243,000
1821	26,515	251,808	502,865
1822	31,105	267,777	538,880
1823	23,232	264,770	578,587
1824	25,452	394,383	547,456
1825	26,684	439,248	630,920
1826	36,930	410,608	541,377
1827	47,761	423,224	575,886
1828	35,674	470,869	696,623
1829	42,840	435,840	320,592
1830	51,128	621,560	337,298
1831	35,911	506,917	326,401
1832	37,525	489,604	461,564
1833	42,677	580,171	506,927
1834	48,788	620,008	741,400
1835	70,908	614,978	766,866
1836	205,140	794,786	
1837	272,133	780,429	
1838	334,563	601,440	1,227,433
1839	340,373		
1840	394,954		
1841	451,003		
1842	515,975		

The above will shew the extraordinary increased export of coals to France, since the removal of the oversea duties in 1834; but it will also show what a formidable rival we have in Belgium. At the same time, it must be taken into account that a great proportion of the Belgian coals is consumed in the interior of France, and to which the English coal could not force its way; but it is in the Parisian districts, in Antwerp, Holland, Rouen, Marseilles, &c., where the real competition arises, with which parts the Belgian and French collieries are connected by cheap and efficacious canals and navigable rivers;

and, therefore, it cannot be for a moment doubted that any export duty, imposed upon English coal, must have a tendency to diminish the powers of competition: and seeing the general depression of the trade, the continuation of export duties cannot but be attended with great injustice and most prejudicial effects.

		Per Ton. s.	d.
In 1842,	English coal could be delivered at Rouen for	29	0
	Belgian - - - - - - -	28	0
	English, at Rotterdam - - -	16	6
	Belgian - - - - - - -	16	9
	English, at Marseilles - - -	23	3
	French, same price.		

The coal mines of Prussia produced—

		Tons.
In 1832	-	1,300,000
1836	-	1,800,000
1837	-	2,000,000

The value of which was about 5s. 6d. per ton.

With respect to the progressive increase of the coal trade, I take leave to subjoin a few leading facts recorded in a pamphlet, entitled "Remarks on the Present State of the Coal Trade," and published in 1843.

It is therein stated, that in the year 1773, there were only thirteen collieries on the Tyne; that in 1800, there were upwards of thirty; and in 1828, the number had increased to forty-one, and eighteen on the Wear; making in all, fifty-nine; and their powers of working, rated at 5,887,522 tons.

From 1828 to 1836, the aggregate capabilities of the district had sprung from 5,941,812 (including the Tees) to 9,623,922 tons, being an increase of 3,682,130, or fully 62½ per cent.; and from 1836 to 1843, the increase is in a similar ratio.

In 1829, Mr. Buddle reckoned the number of persons engaged as miners and in the aboveground operations at 21,000; and, according to the late returns, they amount to 33,990.

In 1829, the number of ships averaging 280 tons, employed in the London and coasting trade, was 1,400, navigated by 15,000 seamen; and at the period of the publication of the pamphlet, there were engaged in the home trade 2,000 vessels, requiring no less than 22,000 seamen, being at the rate of four men to every 100 tons of coal.

This is altogether apart from the ships and sailors employed in the foreign coal trade.

Upon the 27th March, 1844, a deputation of coal-owners interested in the coasting and oversea trade, waited upon Sir Robert Peel, in consequence of an expressed intention of taxing coals for the raising of a fund to carry on the improvements of London river; when they submitted the following most important statements relative to the present magnitude of this trade, viz.:—

That the capital embarked in the different branches of the trade, amounted to the enormous sum of £9,500,000, employing upwards of 33,000 men and boys, with their various dependants; and that the maritime interest in this trade furnished, in 1841, the following proportionate employment, as compared with the general trade, viz.:—

	British.		Foreign.	
	Ships.	Tonnage.	Ships.	Tonnage.
Total quantity employed	4,138	719,190	2,932	285,532
Employed in the coal trade	4,031	702,575	2,842	275,490
	107	16,615	90	10,042

Thus shewing that only 197 ships, equal 26,657 tons, are employed in the North of England, otherwise than in the coal trade; the whole consisting of 7,070 ships and 1,004,722 tons.

That the declared value of coals, exported in 1843, was - - - - - -	£686,331
The value of freights, on an average of 10s. per ton, on 1,845,861 tons exported, is -	922,930
	1,609,261
Proprietors of the mine for rent - - -	30,700
Leaving for labour and materials in working the coal, and for the ship-owner - -	1,578,561

That on the faith of the parliamentary declarations of 1833 and 1836, in favour of the policy of leaving coal untaxed, fresh fields had been laid open, railways extended, navigation improved, harbours constructed, and ship-building carried on to an enormous extent.

That the export of coals in 1833, was only 615,255 tons, whereas in 1842 it had increased to 1,996,566 tons ; and during the same period, the ships in the northern ports alone had increased from 2,364 to 7,070.

The retrograde movement in 1842, when the 2s. per ton duty upon oversea coals took place, produced the following results :—

	1842.	1843.	
Export of round coals	1,828,069	1,347,275	480,794 Decrease.
Ditto small coals	148,001	455,888	307,887 Increase.

Leaving a balance in decrease for 1843, of 172,907 tons.

In further illustration of the injurious effects of the imposition of coal duty, the deputation shewed that the coke, being free from duty, had gradually increased, as follows :—

Years.		Tons.	Years.		Tons.
1840	-	13,783	1842	-	23,434
1841	-	16,514	1843	-	42,698

The reduced freights of the shipping, in consequence, were also exhibited, viz. :—

	1841.	1843.
To Rouen, per killog. of 25 tons	£15 10	£13 0
Havre - - - - -	8 10	7 10
Amsterdam - - -	11 0	8 15
Rotterdam - - -	9 10	9 0

And all other freights in the like proportion.

That the price of coals had also been reduced in proportion, in order the better to compete with the coals raised in foreign countries; and that the price so reduced was in many instances arriving at a point below the cost of raising, which would naturally bring about the abandonment of many collieries, and throw out of employment great quantities of workmen, unless government agreed to repeal the present oversea duty, and abandoned the idea of taxing coal for any purpose connected with the improvements of the river Thames or the metropolis.

With respect to the future prospects of the trade, or what course it would be desirable to adopt to remedy the present difficulties, I am free to confess, that it is an exceedingly difficult question. Nevertheless, it appears to resolve itself into two points, viz., a regulated, or an open trade.

The evils of regulation heretofore, have been the limited quantity allowed to each colliery under the abridged trade; but this has been felt more severely by the long worked and smaller collieries, where, in many instances, the quantity has been so limited, and the price so depressed, that nothing but a losing trade could result; and a strong feeling has prevailed, that their relief could only arise from a concession of the quantities disposed of by great and highly valued collieries for the general good. This feeling has been so urgently advocated, that the present regulation agreement contains a clause for a general revision and settlement of the basis of every colliery in in the trade; every individual thus satisfying himself with the hope, that such general review will benefit him at the expense of others. This is the present understanding; but in the opinion of experienced persons, such period will never arrive, inasmuch, as the investigation would be next to endless, and would, in all probability, create greater and more general dissatisfaction than that which prevails at present. But, until that day shall arrive, or unless some great and unlooked-for market start up, the evil complained of must not only continue, but must increase in proportion as the new collieries come in, since there is no appearance of any of the old ones going out.

The other alternative, which has been frequently discussed, and not unfrequently threatened, is an open trade. Some persons are of the same opinion as was expressed by Mr. T. Wood, before the parliamentary committee of 1836, and which was reiterated by the writer of the pamphlet signed Anti-Monopolist, in 1843, viz., "That in the event of an open trade, the best coals and largest collieries would take the lead in supplying the markets, that the reduced price would be in some measure made up by the enlarged quantities, and that, eventually, the smaller collieries and inferior coals would be driven out of the market." Now, although this is a very plausible argument, and has been entertained from time to time, by certain owners of best coals; yet we do not find any one at present bold enough to commence the contest. The remembrance of the open trade of 1833 is not yet effaced; for a similar opinion was entertained upon that occasion, and circumstances were, to all appearance, more favourable to that view than at present.

The Tees collieries had not then taken their place in the trade; and of all that vast extent of best coal country around Hetton, there were only the collieries of the Earl of Durham and the Marquis of Londonderry—Hetton and North Hetton—then open. The selling price of best coals, before the trade broke up, was 34s. 6d. per chaldron; and certain experienced persons, calculating upon a similar result to that before-mentioned, laid their accounts for almost unlimited sales, at a reduction of 6s. to 8s.; but before the contest had gone on many weeks, the markets became so glutted and so declining, that the shipowners ceased to buy the coals at any price. The freighting system was necessarily resorted to; and the result was, a depression actually below the produce price, even of the very best coals; during which, scarcely a single colliery was caused to retire from the trade, and the regulation of 1834 was resumed, at the instance of the first-rate collieries.

Without, therefore, assuming much prescience, the question may justly be asked, whether the first class collieries would now start under an open trade, with greater or less odds in their favour than they did in 1833? A great number of collieries, it is seen, are established upon the public railways, from which they would obtain a reduction of charges; and as many of them consist of small and new establishments, they would be laid in during the heat of the conflict, and the owners would watch the first favourable opportunity for resuming their place in the trade.

Other descriptions of collieries might be driven into other hands by the losses under the contest; but the new adventurers would, as a matter of course, enter upon reduced rents and with smaller capital, and would, consequently, become more powerful competitors than the retired parties.

A third set of collieries, being those greatly exhausted in the good seams, or heavily burthened with unavoidable expenses, might indeed become "*hors de combat*" altogether; but if experience have any weight, that number would be so immaterial, that they could not yield any perceptible relief to the trade.

Under this supposed state of things, the best coals would, to say the least of it, have a profitless trade, which would as ill suit many of the proprietors as it would do those of the smaller collieries; for the capital or purchase of such collieries would be in proportion to their prospects. In Hetton colliery, for instance, the shares have been bought and sold many a time over, at the rate of upwards of £500,000; therefore, to have a property of that sort unproductive, whilst the mine is exhausting, is an idea of not the most comfortable description.

With these remarks, therefore, I will take leave of the subject, merely observing, that the unanimous voice of the whole trade seems to declare that a regulation is the only antidote to the most ruinous consequences; even although that regulation may be generally characterised as unproductive in respect to profit.

Conclusion.

Notwithstanding that I have, in the preceding pages, considerably exceeded the bounds which I had prescribed for my treatise—yet I confess that I owe to the reader an apology for having unwillingly passed over several interesting subjects in a cursory manner; for it is desirable to mention, that several statistical records, needful for elucidation, could not be had recourse to—whilst others, when obtained, presented so many difficulties in respect to arrangement and condensation, that I despaired of being enabled, in this part of my work, to give satisfaction to the general reader. Should the time ever arrive in which government shall legislate upon this very important subject, and, as a matter of course, provide details and registers for every working colliery in the kingdom; then, indeed, will future historians have an agreeable and comparatively easy task; or should this little work meet with that patronage which would lead me to believe that my attempt had succeeded, I might be induced, in a future edition, not only to enlarge upon the subject generally, but also to accompany it with an elementary work upon the winning and working of mines, accompanied, as it ought to be, with suitable illustrations. The nature of coal mining has, no doubt, been frequently the subject of abstract publications; but I am not aware that any specific work has yet emanated from the pen of any practical person. This is surprising, considering the great national interest that coal mining possesses in this kingdom.

ADDENDA.

As a practical example of the difficulties which are experienced in the winning of the deep collieries of this district, especially where the sand lying at the bottom of the magnesian limestone is intimately mixed with water, I beg to insert a few of the particulars of the winning of Dawdon, or, more properly speaking, Murton Colliery, under the management of my friend, Mr. Edward Potter.

The South Hetton Company (Col. Braddyll and Partners), having considerably increased their tract of coal under lease, decided on the propriety of also increasing their powers of working. A scite for a new winning was fixed upon by Mr. E. Potter, the company's viewer, and the necessary borings commenced, to ascertain the thickness of the sand underlying the magnesian limestone. This having been accomplished, the ground was broken for the first shaft, on the 19th February, 1838. Two months afterwards, another shaft was begun and carried forward simultaneously—both pits being 14 feet in diameter.

The upper stratification consisted of—

	Fa.	Ft.	In.
Soil, gravel, and strong blue clay - -	7	4	9
Soft marl, mixed with beds of craggy limestone - - - - - -	48	4	9
Strong brown limestone - - -	19	0	0
Blue metal (soft) - - - -	0	2	6
Quicksand - - - - - - -	5	4	6
Total - -	81	4	6

Little or no water was met with till the pits reached the depth of 32 fathoms, after which the quantity gradually increased, until the sand-feeders were encountered, which were successively tubbed off whenever favourable foundations were met with; so that, previous to the sand being tapped, the shafts were freed from water. On the 26th June, 1839, the sand-feeders burst away from the bottom of the shaft, throwing up, with gigantic force, four feet of strong limestone which intervened between the bottom of the shaft and the top of the sand. With such violence did this eruption take place, that before the capstans could heave the pumps up from the bottom, they were all choked, and upwards of ten feet of sand deposited in the pit.

The difficulties of this gigantic and critical undertaking now commenced in earnest. The engine power placed on the shaft, which first pierced the sand, not being able to make any impression upon the water, several large boreholes were made through the bottom of the other shaft, (then close upon the sand,) so that the united engine power might be applied. This being accomplished, every nerve was strained to make the application most effective—4,678 gallons per minute were drawn to bank for some time, without making any sensible impression upon the feeders, and which thus effectually prevented the further progress of sinking.

This difficult and unpromising state of things would have allayed the ardour of less adventurous speculators; but the company were determined that the prize should not be lost to them without a struggle, notwithstanding the warnings and condolence of many sage persons in the trade.

Another shaft of greater diameter than any hitherto sunk was commenced, furnished with an unprecedented force of engine power, as applied to one shaft. This new pit was urged forward with every dispatch, and in six months reached the depth of 73 fathoms, being completed with walling, metal tubbing, brattice, pumps, cisterns, &c. Two pumping engines, and two winding engines, constructed also to pump, were likewise erected upon this shaft, and were set to work simultaneously with the sinking. The total amount of engine power thus brought into action was as follows, viz.:—

	Horse Power.
3 Pumping engines of 350 horse-power each =	1050
2 Winding engines also employed in pumping, of 130 each - - - - =	260
1 Winding engine, Ditto - -	100
2 Winding engines for drawing stones, of 25 horse-power each - - - - =	50
1 Winding engine, Ditto - -	18
Total - -	1478

To maintain this enormous engine power, 34 boilers were required, and also 27 columns of pumps, viz.:—

18 columns of 19½ inches diameter.
9 columns of 16 inches diameter.

Total 27

When the necessary preparations were completed, the sand was broached in the last-mentioned pit, and the operation of sinking the whole of the shafts through it commenced with. The sand, although tolerably firm when dry, was found to be so disintegrated by the action of the water, that it was necessary to suspend the men whilst working in it. The scouring effect of this mixture of sand and water upon the buckets of the pumps, as well as upon the working barrels, was found to be a serious impediment to the progress of the work, the buckets being frequently "worn off" at the end of from two to four hours. The engines at this time drew 10,000 gallons per minute. Every expedient which the ingenuity of the persons in charge of this difficult work could devise, was put in requisition. Fortune at length crowned their exertions, by the successful completion of all the shafts through this formidable quicksand.

The whole of the feeders of water were effectually stopped back by metal tubbing, of from ¾ of an inch to 1¼ inch in thickness, and the shafts rendered perfectly dry.

The two original pits were then sunk to the several seams of coal usually found in the district, and which in this locality consist of 23 beds, five of which are found to be of a workable thickness.

The Hutton seam, lying at the depth of 248 fathoms from the surface, was sunk to on the 15th April, 1843.

The thickness of the three principal seams of coal recognized in the Wear district, were found here as follows, viz.:—

	Ft.	In.
The Main coal - - - - -	6	2
The Low Main coal - - -	4	7
The Hutton seam - - -	5	0

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